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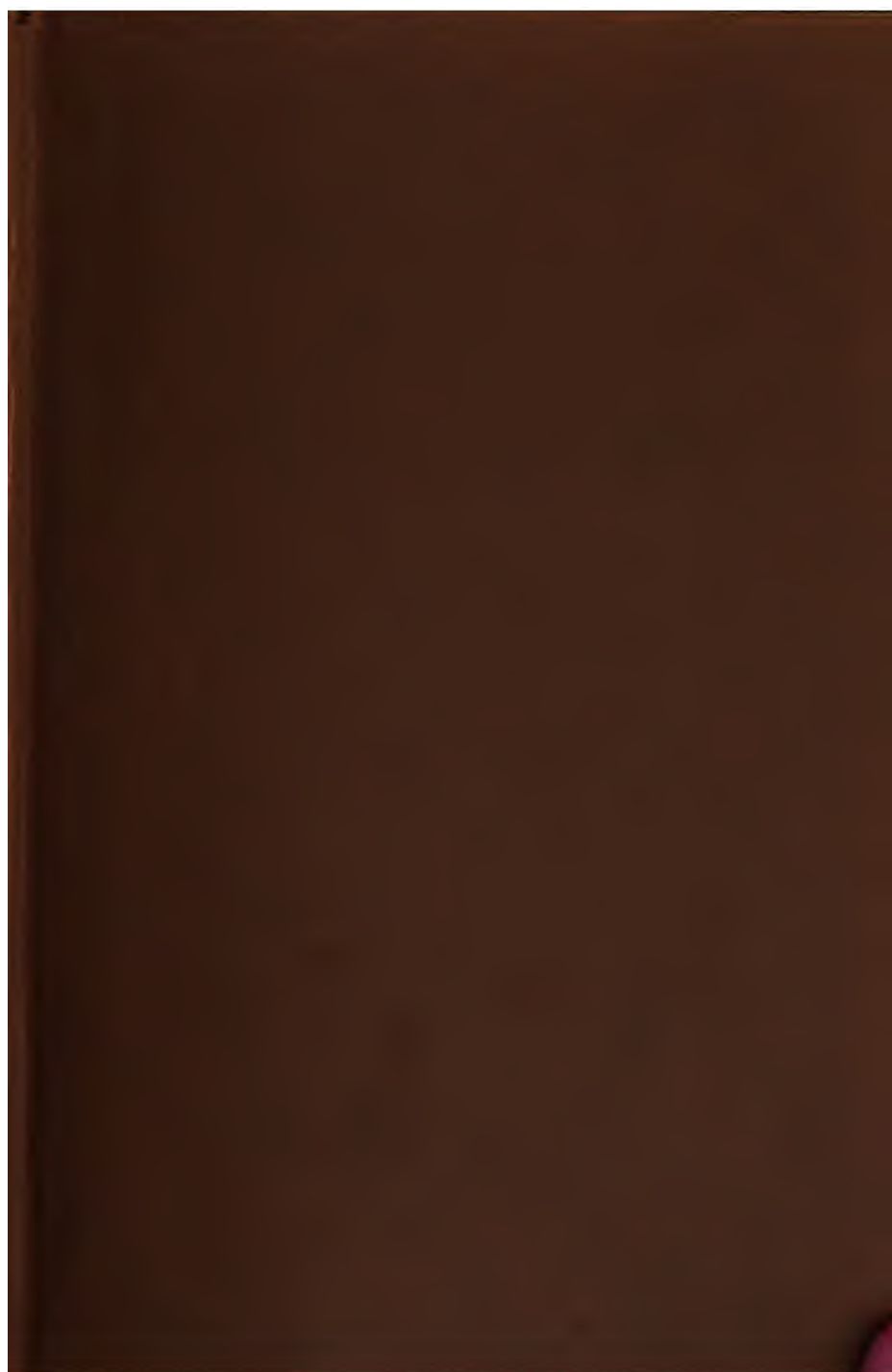
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ALEXANDER VON HUMBOLDT.

ALEXANDER VON HUMBOLDT;

OR,

WHAT MAY BE ACCOMPLISHED IN A LIFETIME.

BY

F. A. SCHWARZENBERG.

“Earnestness alone makes life eternity.”—CARLYLE.

“He was a being of deep reflection—one
That studied nature with intensest eye;
Watching the works of air, earth, sea, and sun,—
Their motion, altitude, their form, their dye—
Cause and effect. The elements which run,
Or stagnant are, he traced to their source,
With vivid study, till his pencil makes
A perfect likeness; or by fancy's force,
A new creation in his heart he takes,
And matches nature's progress in his course
Towards glory. In the abstractions of the mind,
Harmony, beauty, and identity,
His genius, like the summer sun, was shrined,
Till union and perfection he could see.”

WORDSWORTH.

LONDON:

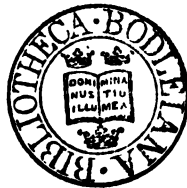
ROBERT HARDWICKE, 192, PICCADILLY.

1866.

210. f. 95.



“Per aspera ad astra!”



TO

SIR RODERICK I. MURCHISON, K.C.B.

G.C.ST.A. D.C.L. LL.D. F.R.S.

DIRECTOR-GENERAL GEOLOGICAL SURVEY ;

PRESIDENT OF THE ROYAL GEOGRAPHICAL SOCIETY OF LONDON,

ETC. ETC. ETC.

AND TO

GENERAL EDWARD SABINE, R.A. D.C.L. LL.D.

PRESIDENT OF THE ROYAL SOCIETY,

ETC. ETC. ETC.

THE FRIENDS AND FELLOW-LABOURERS OF BARON A. VON HUMBOLDT,

The following Biographical Sketch is Inscribed,

WITH EVERY SENTIMENT OF PROFOUND RESPECT AND GRATITUDE.

P R E F A C E.



I HAVE with great diffidence ventured upon the following biographical sketch, based upon Professor Klenke's "Denkmal." My sole apology is that my humble effort to popularize the memory of Humboldt has received encouragement from many men renowned in science—some of them personal friends of that illustrious man. I indulge the hope, however, that the interesting nature of the subject will go far to atone for my inadequate treatment of it. The reader will no doubt meet with many defects of style inseparable from efforts to think in one language and express those thoughts in another; and I therefore bespeak his indulgence for my attempt to write in a tongue I never learned from my mother's lips.

To treat a great theme greatly, requires something of cognate greatness. To this I do not pretend.

F. A. S.

ALEXANDER VON HUMBOLDT.

OUR researches into the phenomena of the physical and the human cosmos present us with many curious parallels. In those two distinct, yet inseparably united realms, there are periods when the creative energies seemed to slumber, and periods when they seemed to manifest themselves in splendid and unwonted energy. Like the aloe, which, according to popular belief, flowered but once in a hundred years, then putting forth a blossom of marvellous beauty; so nature atoned for her seeming sleep by the creation of minds which became new vital forces in the world of man. One star did not rise alone in the twilight of heaven: great men dawned upon the world in constellations. Sometimes a decade of years saw the advent of those who were to give character to the century in which they lived. Sometimes a

single year was marked in this way; and such was the year 1769. Between the chimes of its new year's morn and the last setting of its December sun, were born into the world, Cuvier, Wellington, Napoleon; Sir Thomas Lawrence, long the first portrait-painter of the age, and President of the Royal Academy; William Smith, called the father of English geology, and Alexander von Humboldt. Various sciences and arts were thus represented. I would not attempt to trace characters so varied, — destinies so unlike: for me the life of Humboldt, in its consistency, its integrity, its success, and its rewards, possesses a complete power and symmetry which none of his renowned compeers could show. Few men have lived for so long a time under the eyes of the world. There is no life, however insignificant it may appear, which does not in some way advantage the world. But a life like Humboldt's, enriched with the experience of two centuries, and illuminated by a long series of splendid achievements, opened a new avenue into the realms of truth and of science. I would, therefore, attempt to speak of the mind and the heart of Humboldt, of his capacities, his ideas, his character; of his place, not merely as a man of science in the world of

knowledge, but pre-eminently as a man in the world of men. It is good to contemplate the union of a well-balanced character with a completed and harmonious destiny. Like the Grecian mother, who feasted her eyes on perfect statues, that her unborn child might possess something of their beauty, so that divine order which Humboldt sought for with religious fervour throughout the material world, seemed at last to be reflected in the wonderful symmetry of his life. Fortune, however, was less partial than people were apt to suppose. And, though Humboldt was born under a happy planet,—and it is difficult to imagine circumstances more favourable than those which surrounded his childhood,—yet the same good fortune in hundreds of other instances would only have produced mediocrity. The germ of character lay far below the influence of circumstances.

The history of Humboldt's early life, though meagre and imperfect, yet furnishes the necessary clue to its grand development. His first teacher* was the translator of that wonderful fiction, more real than reality, "Robinson Crusoe." His friend and companion was George Forster, who had accompanied the celebrated

* J. H. Campe.

Captain Cook in his second voyage round the world. All his early recollections were mingled with stories of travel, adventure, and discovery; and, wandering among the pine-woods of his father's estate, his imagination enlarged them into vast continents, the arms of the lake expanding into breadths of ocean, hiding somewhere in the distance unknown islands. And long afterwards, when much of his labour had been accomplished, and his sacred fame was all secure, he observed that the impression aroused within us in early childhood always took a graver direction in after-years. The educational method of Rousseau had already found entrance and acceptance in Prussia, and had given rise to more liberal plans for the education of youth; and to those ideas Humboldt was indebted for a course of training which developed his body and mind in an equal degree, and allowed full play to the gratification of all his natural tastes. He was not the only child for which that crazy philosopher received a father's blessing; but in no other instance was his system so nobly justified as in Alexander von Humboldt. Noticing that the boy exhibited a more than ordinary interest in trees and plants, his teacher made him acquainted with the rudiments of botany, and explained to him the twenty-four classes of

the Linnæan system. He soon perceived, however, child as he was, that one science was but a single door to the great temple of nature; and he was not satisfied without possessing the keys to all; and his researches, commencing with the blossoming of a nettle by the wayside, finished their course among the beams of the remotest star.

A survey of the whole life of Humboldt, enriched by the manifold conceptions of three parts of the globe, manifests the ever clear and calm mind, which, in the storms of the sea, upon the cold glaciers, in the beautiful and fertile valleys, the great forests, and the immeasurable space of the heavens, calmly with an observant eye, received the world into himself, and reflected it again in the transfiguration of higher comprehension, awakening in him feelings of rapture for the beautiful and the sublime. But these impressions, instead of distracting his mind, did rather concentrate its powers; they conducted him to the depth of a phenomenon, not to the mere surface only; they prompted him to solve the part in its natural connection with the whole, and to comprehend the all-consolidating and mysterious forces of nature. With these splendid results of his knowledge, he appeared as a holy stream flowing over

the banks of strict science into the fields of the civilized world : he broke through the barrier which separated science from actual life ; his object was not only to labour for the advancement of science, but more for the benefit of humanity. From this point of view we must consider the expression of an enthusiast who somewhere exclaimed that Humboldt was related to, and identical with, a conqueror of worlds ; a reformer, a founder of a religion. Few ever painted with so much fidelity the remarkable scenes he had witnessed. This faithful representation of nature is the rare and the peculiar merit of Alexander von Humboldt. No one could reproduce to me, who had himself seen and felt it, with more power the fiery atmosphere of the South American valleys. His habits of observation as a naturalist aided in giving character to his descriptions of scenery. In his voyage on the Upper Orinoco, he referred again and again to the saddening impression produced by those magnificent scenes, where a savage vegetation seemed to have usurped the whole earth, and man was nothing in comparison. In those reflections the man's heart seemed rather to speak than the philosopher's brain. This equinoctial journey may be considered a great personal achievement of Hum-

Humboldt's life, consuming almost his entire fortune, and twenty years of labour. It caused a considerable sensation in Europe, because such a gigantic undertaking of a private individual was without a parallel, — free from all personal egotism, a voluntary sacrifice for science and humanity. Humboldt's way, prepared through the discovery of the western hemisphere in the fifteenth century by Columbus, reflected with peculiar interest on the consequences of these discoveries; because he became, in contrast to Columbus, the geographical explorer of America; the scientific discoverer of these regions. Humboldt's name ought, therefore, to be placed at the side of Albertus Magnus, Roger Bacon, Vincent de Beauvais, Columbus, and Gama. The two latter are the discoverers of that space from which Humboldt dispersed the darkness; and, in reality, he discovered America for science. Thus were offered to the western nations of Europe the most valuable materials for the foundation of a physical description of the earth, in an already agitated period of time, when a great number of Europeans came in direct and intimate connection with the gorgeous tropical regions of South America. All know, at least partially, what the results of Humboldt's labours are; but his researches were too varied

and too vast to have enabled him to obtain pre-eminence in any one science; or rather, he was so equally eminent in all, that his true greatness seemed to be accepted rather than critically understood in the world. Perfect symmetry never produces the effect of vastness; and this was the case with Humboldt. With, perhaps, the exception of Aristotle and Bacon, no man ever stood forward so prominently as the representative of the aggregate knowledge of his age. And it was impossible to estimate the influence he wielded in advancing the sciences, not only directly, but indirectly, in the impulse he had given to other minds, in aiding by his counsel and his means those who were struggling against difficulties. Never was a man less exalted by his own individual achievements; never was there a teacher so eager to be taught in turn; never a mind so humble under its wonderful weight of knowledge. From my own personal impression, as well as from a study of his works, I would venture to guess the motives of that vital inspiration which gave shape to his life; to go behind what he accomplished, and speculate on what he designed; for common minds only work out their ideas; great minds look to a goal which they can never reach. All the labours of Humboldt's

life were but colossal fragments of a plan too vast, perhaps too sublime, for any single life to complete. It is true he enjoyed a much longer life, more abundant opportunities, more vigorous and tractable powers of mind, than were given even to the most fortunate of men ; but this was not enough. He desired not merely a scientific survey of the earth, but the discovery of those eternal laws which governed its creation, and which still regulate its existence.

If his life and his powers had been adequate to the task, he would have devoted several years to the exploration of Central Asia. After that he would have wrested from Africa the secrets it contained. He then, from the knowledge thus collected, could lay down the science of climate, sketch the geographical outlines of continents, define the boundaries of the various systems of plants, animals, and men ; and from the height of his vast experience, strive to comprehend the secrets of that divine system to which the whole order of creation moves. When the astronomer Kepler, after twenty-five years of labour and suffering, discovered those mathematical laws by which the planets are balanced in space, and the whole solar system was unfolded to his view, he cried out, in a

truly religious triumph, "Oh, Almighty God, I think thy thoughts after Thee." To Humboldt the active forces of nature were equally the thoughts of God. Such noble daring as urged him to comprehend them, was, indeed, one of the sublimest devotion. There are, I know, shallow-headed critics, who endeavour to throw doubt on Humboldt's Christianity, because his feelings were too deep, too profound to be ordinarily exhibited; and there are those who, because there did not happen to be in botany or astronomy, or physical geography, anything which substantiated special doctrines, denounced all science as atheistic. Now, I would ask, who does best understand the sun, the owl or the eagle? For my own part I always approach with awe the profound religious sentiments which underlay the life and the character of such a man as Humboldt. The ideal of his life, like that of every true man, was too great to be offered for miscellaneous public exhibition, and a pearl too costly for those ready to trample it under foot.

The mind of Humboldt was in one respect almost a phenomenon,—in its power of generalization, and at the same time entering into minute details. It was not inaptly described by Lady Morgan "as reminding her of the

trunk of an elephant; it could snap an oak, and pick up a coin." As a proof of his marvellous intellect, I would here refer to a series of sixty-one lectures, delivered in Berlin, and perhaps one of the most remarkable courses of lectures ever delivered. They were :—

Five lectures treating of the Nature and the Limits of
Physical Geography, and including a General
Sketch of Nature.

Three on the History of Science in General.

Two on the Study of Natural Science.

Sixteen on the Heavens.

Five on the Form, Density, Latent Heat, and Magnetic
Powers of the Earth; and the Polar Light.

Four on the Crust of the Earth, Hot Springs, Earth-
quakes, and Volcanos.

Two on Mountains.

Two on the Form of the Earth, the Connection of Con-
tinents, and the Elevation of Ravines.

Three on the Sea as an Elastic Fluid Garment of the
Earth.

Ten on the Atmosphere, and the Distribution of Heat.

One on the Distribution of Matter in General.

Three on the Geography of Plants.

Three on the Geography of Animals.

Two on the Races of Men.

These lectures formed the foundation of the stupendous production, — "The Cosmos." Humboldt had previously delivered the same course in Paris.

The first of this cyclis of lectures caused such an extraordinary sensation, that not only all the men of learning in, and the immediate neighbourhood of, Berlin assembled, but from the most remote parts of Germany, the friends of science hastened to Berlin, in order to hear at least one of Humboldt's lectures, and to make his personal acquaintance. Night after night, the late King of Prussia, the members of the royal family, the principal members of the aristocracy, were present; and all classes of the people, through the lively interest they took in these lectures, testified their pride in the celebrated Alexander von Humboldt. Nay, more, even the uneducated and the lower orders heard now his name. His personality appeared to them something wonderful and mysterious, and they were anxious to see him who had discovered a new world. Humboldt, unlike most other men of renown in the scientific world, in thus appearing publicly before the people, gave the noble and cheering example that a baron, a high officer of state, and a confidential counsellor of a king, did not consider it below his dignity to appear before the world, as a teacher in the science for the advancement of which he had made such great sacrifices, and in which he occupied perhaps the most distinguished

position; he testified that a true disciple of science ought not to consider himself to belong to an exclusive class; that the representative of science should ignore all the prerogatives of his social position, if in the higher service of science. Baron Humboldt fulfilled at the same time the noble obligation which the higher gifted owes to the people, because from the treasures of his knowledge he instructs them, brings them nearer to himself, to truth, and to reality.

These lectures spoken of were commenced on the 3rd of November, 1827, and concluded on the 26th of April, 1828; delivered extempore and without notes.

The memory of Humboldt was really wonderful. Even Macaulay, who could repeat the whole of "Paradise Lost" from beginning to end correctly, would have to yield to him in that respect. His memory, even to the last, seemed as keen, as vigorous, and as active as ever. He never hesitated for a name or a date, and never confounded the order of events. A friend once called upon him to discuss some points relative to the topography of Jerusalem; and, astonished at what he considered his marvellous memory of the streets and the houses of the Holy City, asked how long it had

been since he was there. "I never was there," was the answer; "but I intended going sixty years ago, and therefore prepared myself." A still more striking instance of this power of memory was exhibited when some ladies were brought to his house to be introduced to him. Among them was the daughter of a gentleman in Philadelphia, with whom he had resided in 1804,—long before she was born. On entering the room, Humboldt exclaimed, without the slightest doubt or hesitation,—"You must be the daughter of my old friend in Philadelphia."

The most prominent traits in Alexander von Humboldt's character,—universally acknowledged,—were his sincerity and his simplicity. Possessed of all the tastes of a man of the world; endowed with all the graces which the best societies in Europe could impart; with all the prerogatives of his birth and position; with all the tempting prospects of an exalted station in his own country, he, with characteristic sincerity, followed rather the natural yearning of his soul, and consécated himself a servant of science and humanity. He sacrificed cheerfully ease and comfort, and laid upon the altar of science all, in search for that knowledge, which would expand the conceptions of ourselves and the world in which we

live; and this I consider to be his high moral position as a man in the world of men. Humboldt, in discovering the secrets of nature and in explaining them to mankind, caused of necessity a great change in the prevailing ideas of the human race, and their purpose of life and reality approached nearer to man. His object was to labour for the whole: his actions are interwoven with the history of mankind. He did not overlook the limits which separate the genius from the great mass, one period of time from another. His idea concerning the purpose of human life was to perceive below the surface of phenomena the soul; and for that purpose he searched for the germs of truth, even in the darkest ages; corrected errors, and assisted in bringing to light facts hitherto overlooked or ignored. Thus did he reach the present high point by the conquered steps of the past; and it is no empty phrase when some one, speaking of his "Cosmos," remarked,—“In order to further Humboldt's researches, the Phœnicians and the Greeks must, two thousand years previously, navigate; Aristotle originate a system of astronomy; and, from the beginning of modern times, Copernicus, Kepler, and Galileo must wage the battle against the prejudices of the people and the

inquisition of the Church." Instruments must be invented to pierce through space; the spirit of history, in alliance with philosophy, must break through the barriers of the world. We are led to such general considerations if we compare the physical sciences before Humboldt's time with the present high position attained through his unwearied and active co-operation.

Before Humboldt's appearance, it was in reality only an endeavour after a correct classification of things which the celebrated Linnæus, after a long period of philosophic-theoretical abstractions and scholastic traditions, attempted and encouraged. The manifest forces of nature were considered incomprehensible miracles, because the physical sciences were subject to religious dogmas. Humboldt appeared with Cuvier, a reformer in classification. Soon afterwards, a zeal was manifested for comparisons on all points of the globe, and an attempt made to explain the complication of various forms of phenomena through the facts thus elicited. On the one hand, the school of Cuvier strictly excluded all speculation, and decided only in accordance with facts discovered; on the other hand, a direct opposite tendency was manifested in classifying not in

harmony with distinguishing facts, but in accordance with principles, and a natural philosophical school constituted itself, which found in Geoffroy St. Hilaire, Schelling, and Oaken, the principal representatives. Humboldt and Cuvier entered simultaneously upon their researches as naturalists. He directed himself to facts; he examined and compared, without ever taking a direct part in the battle of the philosophers, because he had entered upon a new road—a higher and a more comprehensive point of view. He endeavoured to comprehend the universe in all its grandeur. Nature should, through a perfect comprehension of its powers and its laws, in general and in particular, become a lively object of human knowledge—an open book in which the isolated and the small explains itself through the whole and the great. The immense territories of his researches were:—1. The knowledge of the earth and its inhabitants; 2. The discovery of the higher laws of nature, which govern the universe, men, animals, plants, and minerals; 3. The discovery of new forms of life; 4. The discovery of territories hitherto but imperfectly known, and their various productions; 5. The acquaintance with new species of the human race,—their manners, lan-

guages, and historical traces of their culture. In this extensive field Humboldt laboured with unwearied activity, care, and perseverance. The natural consequences of his researches manifested themselves in all the branches of scientific and practical knowledge, and found application in numerous circles of life. His vivid and glowing description, never yet surpassed, of scenes witnessed in distant countries, awakened a desire for travel; they furnished new instruction; the charm of his descriptions inspired numerous youths with a love for nature's beauty; many a thoughtful man, with the resolve to study the laws of nature; and even many a female heart, attracted by the fabulous tropics and the love for grandeur of scenery, learned to pronounce with veneration the name of him whose person is surrounded, in the conception of many, with the enchanting brightness of the mysterious and the marvellous, when they meet him in the description of adventurous mariners, or the perilous wanderings in the wild burning territories of the southern hemisphere.

It has been already said that Humboldt's researches were too varied and too vast to gain for him pre-eminence in one branch of science exclusively. Scientific travellers have either

the one or the other general object in view; they either collect a great variety of material—animals, plants, or stones; institute special examinations, and record their opinion; or else they endeavour to arrange and to classify the results of scientific inquiry; point out the natural continuity, by which process not only facts already known receive additional light, but who introduce new acquisitions in their order and place. It has been said, that while physical science month by month marches upward with sure and rapid steps,—never falling back or returning on its pathway, but scaling the height of knowledge with a ladder which is built of adamant as it advances,—ethics can do no more than illuminate the thoughts of Plato, Aristotle, Epicurus, and the Stoics, with some light of Christian inspiration, or emasculate them with flimsy modern sentiments. Professor Henry Hennesey, F.R.S., in his excellent discourse, delivered before the Philosophical and Literary Society of Leeds, on Tuesday, January 7th, 1862, “On the Relation of Science to Modern Civilization,”—to which I listened with considerable interest,—pointed out, in forcible and eloquent language: “the permanency of all the real acquisitions of science.” “The temporary supremacy of

erroneous or incomplete theories," said the learned professor, "and their necessarily ultimate abandonment, cannot depreciate the generally distinguishing character of departments of knowledge which are founded upon experience. Results derived from observation and reasoning, no matter when obtained, permanently retain a scientific value, which no subsequent progress can entirely efface." Vainly, therefore, does a modern poet exclaim,—

“ Call Archimedes from his buried tomb,
 Upon the grave of vanished Syracuse,
 And feelingly the sage will make report
 How insecure, how baseless in itself,
 Is the philosophy whose sway depends
 On mere material instruments :
 He, sighing with pensive grief
 Amid his calm abstractions, would admit
 That not the slender privilege theirs
 To save themselves from blank forgetfulness.”

It has been well said, that it would be scarcely possible to condense into a briefer space so many elegantly-expressed absurdities. The philosophy here alluded to is physical and mathematical science. Far from depending solely upon material instruments, this philosophy chiefly uses such as are of a purely intellectual character. Most of its material instru-

ments have been devised only by the rarest exertions of mental skill; their successful application ever demands the co-operation of intellectual agencies.

Those scientific travellers who possess both the capacity to collect material and to present new scientific acquisitions in the natural order and place, are very rare; but to this class belongs Alexander von Humboldt; and here he occupies a most conspicuous place, which secured his sacred fame in the world. It is requisite for such a purpose to possess general and positive knowledge; an intimate acquaintance with all known scientific facts; and further, a considerable talent of observation, and the power of generalization; the peculiar capacity to perceive in new-discovered facts, with certainty and intuitively, their positive place and natural connection with older scientific facts; so that by this continued process the unity of the whole is, by every step in advance, more firmly established. And perhaps no one understood this better than Alexander von Humboldt; and his intellectual superiority is above all perceptible in the order and place which he assigned to the rich treasures of his own observation and experience, in connection with all former

acquisitions of science, from the earliest periods to our own time, establishing science on a firmer basis.

The wonderful capacities of Humboldt appear from the fact that he, in his early days,—at the time when certain sciences made their first appearance,—as, for example, Physiology, the science of animal and vegetable organism,—made observations and produced results, whose importance and truth were, only fifty years afterwards, fully comprehended and appreciated, and which proved the remarkable talent of observation of the youthful Humboldt.

Which are the great labours which immortalize the name of Alexander von Humboldt? Which new branches of science did he encourage and originate? What harvest did he bring for the physical sciences in general? We will endeavour to give a brief and general reply to these questions, ere we proceed with the personal history of the great savant.

Humboldt was the first who obtained a clear insight into the relation of all elements of the earth to the universe in general; and he arranged the former complication, in the planless classification of isolated facts, with keen penetration and perfect distinctness;—he separated

the absolute from the accidental, the certain from the hypothesis; the apparent lawless he brought under known laws; united the isolated bodies of the earth into absolute and natural groups. He thus became the founder of a new science, "the comparative description of the earth," whose importance for the life and progress of nations becomes every year more evident.

All the territories of physical geography opened themselves to his mind; he perceives the laws, according to which the organic creatures are distributed upon the surface of the earth, with regard to the various gradations of heat, the soil and the air; and in observing attentively the composition of the air, in different parts, and various heights above the level of the sea; in the bowels of the earth, and on the openings of volcanoes,—he convinced himself that the distribution of heat in the atmosphere; in its horizontal and perpendicular position in space; and also in relation to the seasons, and the locality upon the surface of the earth; the temperature of the oceans, and the solid earth, furnishes the most important ground for a distribution of creatures, in accordance with fixed laws. Principal Forbes, in his learned dissertation "upon the

Progress of Physical Geography," has paid a just tribute to Baron Humboldt, in saying "that no one now living contributed more to the advancement of physical geography." But Humboldt became also the originator of another science,—“Hydrography,”—*i. e.*, the description of the waters of the earth. He had early perceived the importance of the ocean-rivers, and had offered to geography important information with regard to limitation, rapidity, temperature, and changes of the courses of the seas; their influence upon the development of commerce, on navigation, and the history of mankind; and the great project to save the mariners the circuitous road from the Atlantic into the great ocean round Cape Horn, the most southern peak of America, and to make a canal across Central America, was first represented by Baron Humboldt in its true light; and this great project, undertaken for the benefit of navigation in general, was based upon his observations respecting the inequality of the ground and the relation of the waters.

The formation of the crust of the earth was likewise a principal object of Humboldt's investigation, and science is indebted to him for wide extensions, in his examinations and study of the conditions of the crust in the old and

the new world; and his ever clear and quick perception soon recognized an absolute law in the seeming chaos. He became an important labourer in geognosy,—the science of the composition and the formation of the solid crust of the earth; and here he opened a new avenue, presented a new aspect, dismissing the old theories regarding the causes in the changes of the climatic condition of the earth, which must have been, according to existing testimonies, quite different many thousand years ago from the present condition,—because remnants of animals and plants, natives of the south, were exhumed in cold northern regions, which was accounted for by the liberated heat of down-crushed masses of mountains, and similar causes; he recognized the more important activity of volcanic powers in the bowels of the former earth, and concluded, in a most ingenious manner, the then higher temperature of our planet. His labours in this department of physical science are of a most important and positive nature, and exercised upon general science a powerful influence; but as Humboldt never advanced any new opinion without some practical proofs, he brought with him a valuable collection of various kinds of rocks from America, compared them with the

strata as presented in the crust of the earth in Europe, and thus arrived at the important conclusion, that, on the whole, one and the same law operated in the formation of the crust of the earth.

This study of Humboldt respecting the influence of volcanoes, the appearance and the effects of fire in our earth, urged him to examine the nature of earthquakes; and, on this important subject, he produced the first notable facts, and the first specific information. He taught that the hidden multitude of volcanos in the interior of the earth, though many hundred miles distant one from the other, maintain a mutual connection; and hence earthquakes are felt upon a space of several thousand square miles simultaneously. He proved the existence of certain volcanic veins in the interior of the earth, from the directions in which earthquakes propagate themselves, and the order they observe in their continuity; and here again Humboldt presents us with new aspects in the study of natural science. The laborious and careful calculations of Humboldt place the number of known volcanoes at 225; of which 198 are found surrounding the basin of the Pacific. "Thus, while the bed of the Pacific itself is, considering its vast magnitude,

wonderfully free from any break in its crust, "the Pacific Ocean," as Humboldt writes, "whose surface is nearly one-sixth greater than that of the whole dry land of our planet, whose breadth in the equatorial regions, from the Galapagos to the Pelew Islands, is nearly two-fifths of the whole circumference of the globe, presents fewer smoking volcanoes, fewer openings through which the interior of the planet still maintains active communication with its atmospheric envelope than does the single island of Java. On the other hand, we find this vast basin surrounded by a well-marked line of volcanic fracture, at present containing, as already stated, seven-eighths of the known volcanoes of the globe."

Thus, "beginning from New Zealand," in the words of Humboldt, "and proceeding first for a considerable distance in a north-west direction, we can pass through New Guinea, the Sunda Islands, the Philippines, and the east of Asia, and, ascending to the Aleutian Islands, can redescend to the southward through the north-west portion of America, Mexico, Central and South America, to the extremity of Chili, thus making the entire circuit of the Pacific Ocean, and finding it surrounded, throughout a length of 26,400 geographical miles, by a

series of recognizable monuments of volcanic activity." *

But should not Humboldt, who so well knew the interior of the earth, have directed his attention to the precious treasures—the metals? In America and in Siberia he searched for the laws which necessitate the presence of metals; and he thus discovered the most important fact, with regard to mining, that to a certain degree, with reference to the beds and the distribution of gold and platina, there must have been in America and in Siberia analogous circumstances; and, at his suggestion, diamonds were discovered in the gold-mines of the Ural Mountains. It would be a subject worthy of consideration to notice in detail the conspicuous examples of the influence which the discovery of precious metals exercised on the rise and the progress of nations. "Gold dust led more Spaniards to follow in the footsteps of Columbus, of Cortez, of Pizarro, than the spirit of adventure, or the religious zeal which sought to ennoble it. Its influence is perceptible in the commercial greatness of the Phœnicians, certainly as old as the days of Abraham, when all was gold, from the earrings of the Midianites, their carriers of the desert,

* Narrative of Surveying Voyages of H.M.S. *Fly*.

to the chains that were about their camels' necks; we trace it through the fleets of Hiram, laden with the gold of Ophir; through the glory and the splendour of Solomon; through Carthage and her hundred cities along the shores of the Mediterranean; through the ancient refinement and barbaric splendour; through the history of Jews and Gentiles; through settlement by land and by sea."

"Hugely as the shores of the Mediterranean are exceeded by the shores of the Atlantic, so are the shores of the Atlantic exceeded by those of the Pacific. Already, along the vast and hitherto silent shores of that great ocean—from California to Australia, from New Zealand to British Columbia—empires are springing up, and cities grow, as it were, in a day. Rapid as has been the progress of the United States of America, it has been found that the state of California has increased as much in one year as many of the Atlantic states in a whole century. It has been said that Melbourne has grown more populous, more wealthy, and of greater political importance, in ten years, than Sydney in fifty."

The series of gold discoveries, which commenced with 1847, has, within the last few years, assumed gigantic proportions. Already,

in 1846, Sir Roderick Murchison, who, two years previously, compared the eastern ridge of Australia with the Ural Mountains, and first suggested in print the auriferous character of the former, advised the Cornish tin-miners, who were then out of employment, to emigrate, and dig for gold in Australia, and wash it as they did their tin ore (see *Trans. Geol. Soc. of Cornwall*, 1846). In 1848 some results were in the possession of this eminent geologist, and he wrote a letter to Earl Grey, then Secretary for the Colonies, indicating that the all-important question of the gold of Australia, and the laws relating thereto, should be well considered by the Government (see *Parliamentary Papers*, third series). However, three years elapsed before 1851, when Mr. Hargreaves opened the diggings. It appears that the geologists who at first sought to restrict the deposits of gold to a narrow compass were mistaken; and although the range of territory in which gold has been discovered is thus extensive, the great principle laid down by Sir Roderick Murchison in his earlier researches, and repeated in the last edition of his "*Siluria*," should not be forgotten, viz.; "that the rocks which are the most auriferous are of the Silurian age, and that a certain geological zone only in the crust of the

globe is auriferous at all." Sir Roderick has furnished valuable information on this important subject, not only in his "Siluria," but "Russia and the Ural." His views regarding the durability of the auriferous quartz reefs of Australia were almost unanimously accepted by the scientific men of the colony. Humboldt's previous and extensive researches afforded valuable material, and opened a wide field for these investigations. His general views on this subject are perhaps the most satisfactory, and have certainly remained undisturbed.

Whilst Humboldt thus furnished valuable information regarding the mysterious life of our planet in the great features of its phenomena, his mind was also directed to the silent world of plants, in order to discover the great law of their existence. He did not despise, besides his more important general labours, to collect a variety of herbs; and in his sublime conception of the life of plants, relative to the condition of the soil, he was enabled to establish a new science, — "the Geography of Plants," *i. e.*, "the science of the distribution of plants and their laws." He proved distinctly the connection of their propagation, with regard to various heights and climatic conditions, and uniting his observations with

those of others, from the most remote parts, into a natural circle of order and law ;—Humboldt described a world of unknown plants, and raised the science of botany, before that time much neglected, and only a matter of memory, to the position of one of the most attractive of all the physical sciences, in showing the remarkable influence of the, in itself, silent world of plants, upon the formation of the soil, the condition of peoples, and the historical development of the human race, from the primitive period of the world's history. Humboldt awakened thereby a new interest in the physical sciences in general, in connecting them inevitably with the history of the human race, and liberating science from all mysterious interpretations ; thus even those less acquainted with science might become interested in it ; for his representations were based upon clear facts, and a practical conception of nature, presented in an elegant form, and with considerable power in the delineation of his perspective views of the whole picture.

In close connection with the researches respecting the condition of soil, is Climatology ; and in this department Humboldt became again the founder of a new science—"the Comparative Climatology." He originated a new science,

founded upon his researches into the territories of meteorology, the conditions of heat and electricity ; the distribution of heat upon the earth, in so-called isothermal lines, by which he connected all places upon the surface of the earth which have an equal medial annual temperature, which proved that the equator of heat—the line which one discovers in connecting the hottest points of the earth one with another—in nowise harmonizes with the earth-equator ; wherefore those parts of the globe situated near the equator, and having the rays of the sun perpendicular, are not always the hottest.

These isothermal lines form an important part in Humboldt's scientific researches ; and more especially in his maturer years, the study of this branch of science was a very favourite pursuit. Already, in 1817, when he published, in the third volume of the French journal, his "*Mémoires d'Arcueil*,"—a part of the treatise "*de la Distribution de la Chaleur et des Lignes isothermes*," he had been long engaged with the distribution of heat upon the earth, and had endeavoured to fix more accurately the direction and form of the isothermal lines. Thus, ten years later, on the 3rd of July, 1827, he delivered a lecture at the public *séance* of the Academy of Science "respecting the principal

causes of the difference in the temperature of the globe;" and, lastly, in his "*Fragmens Asiaticques*," he offered the results of his comprehensive investigations with reference to this subject to the world. He showed that, whilst Western Europe has a more insular coast climate, the eastern parts and the whole of Asia are distinguished by a continental climate, which, in the heat of the summer and the cold of the winter, produces regular opposite results; and though, on the southern confines of Siberia, the continual perpendicular rays of the sun cause necessarily heat, the effects are no others but that, in that part, very hot summers invariably succeed extremely cold winters.

Nowhere found Alexander von Humboldt finer grapes than at Astrachan, on the shores of the Caspian Sea; and yet there, and even more southward, at Kislär, on the mouth of the Tarek,—in the same latitude as Avignon and Rimini,—the cold in the winter reached from 28 to 30 deg. Celsius' thermometer. This great contrast between the heat in the summer and the cold in the winter, Humboldt calls a peculiarity of Siberia. In these parts they are compelled to bury the vine deep in the earth during the winter months; and in sum-

mer, in consequence of great drought and heat, the vitality of the same must be preserved by artificial watering. Up to 58 deg. latitude, Humboldt could, with tolerable certainty, determine the mean temperature of these localities from the degrees of the heat in the springs. More northward, the soil is from 12 to 15 feet deep always frozen; whilst in Norway,—situated equally high, and higher towards the North Pole,—even in winter, grass and moss are growing under the cover of the snow. Humboldt had a well sunk in the midst of summer, and encountered already, at a depth of 6 feet, ice $9\frac{1}{2}$ feet thick; and it is a remarkable phenomenon that, in spite of these subterranean masses of ice, the short but powerful heat of the sun during the summer months rapidly causes the upper soil to thaw, assisting in the production of an abundant harvest. The subsequent results of this Asiatic journey of Humboldt were of the greatest importance to science. After he had left on many points of Siberia, in the hands of experienced or able men, carefully compared thermometers, and had more especially awakened in the officers of the Russian Government mines a zeal for such mensurations and comparative examinations, he urged the Imperial Academy of St. Peters-

burg to co-operation, and presented an excellent plan, showing that, in all parts of that vast empire, a regular system of observation, regarding the daily changes of the barometer, the thermometer, and the hygrometer,—the temperature of the soil, the direction of the winds, and the moisture of the air,—might be originated. To the interest which the scientific men of the Academy evinced in Humboldt's plans, an additional impulse was given by the attention of the Emperor; and if we bear in mind that the Russian empire is a continent,—an area more extensive than the surface of the moon, presented to our view,—it becomes evident that important laws relative to the whole life and activity of our planet would be investigated and explained. The Russian Government, in recognition of the importance of the plans submitted by Alexander von Humboldt, caused the erection of an observatory at St. Petersburg, which was charged with the selection of suitable places for scientific observations, with the selection and examination of the necessary instruments: further, to ascertain the precise position of these selected spots in an astronomical point of view; to watch with special care the magnetic and the meteorological investigations; to arrange and to estimate the

facts thus obtained; and publish regularly the medial results of these united researches. The special mineralogical and geognostical investigations of this Asiatic journey became a separate field for the companion of Humboldt's expedition, Gustav Rose, who published the results under a special title,—“Mineralogical-Geognostical Department, and Historical Account of the Expedition.” The whole work is entitled, “Expedition to the Ural, Altai, and the Caspian Sea, by order of the Emperor of Russia, in the year 1829, undertaken by Alexander von Humboldt, G. Ehrenberg, and Gustav Rose.” Before, however, the third part of the work, which contained the results of Ehrenberg's botanical and zoological researches, and the geography of plants and animals, had appeared, Humboldt himself published a new work, entitled; “*Asie Centrale, Recherches sur les Chaînes des Montagnes, et la Climatologie comparée*,” — Paris, 1843, — in three volumes.

In this important undertaking, Humboldt received the voluntary and cheerful assistance of the most able scholars in the Oriental languages, and likewise the co-operation of such renowned scrutateurs as Klaproth, who furnished new notes from Chinese sources; Stanis-

laus Julien, member of the Institute of France, who offered physical and orographical (descriptions of mountains) notes, and by whose friendship, as Humboldt publicly declared, he felt himself honoured ; Eugène Burnouf, who made, in furtherance of Humboldt's plans, important ethnographical and geographical researches in the Zend books,—studies which Humboldt highly valued. Physical geography was thereby enriched with new sources of valuable information,—the acquaintance with the direction, the formation, and the geological peculiarities of the great mountain-chains of Asia. The method of Humboldt to compare continually all elements of science one with the other, produced a wonderful solidity and exactness. The constant direction to similar and to opposite observations in Asia, America, and Europe, laid the foundation of the present position of climatology ; in furtherance of which all physical sciences furnished most important explanations.

Only those well initiated in all branches of physical science can here perceive and comprehend Humboldt's greatness. The masses of the people can only admire the mystery of his achievements. Thus Mahlmann, the German editor of "Central Asia," who had already some years previously furnished an in-

teresting sketch of Humboldt's achievements, concluded his preface in these words:—"If Alexander von Humboldt is the principal originator and representative of the spirit of the age which manifests itself in a general endeavour after universality,—and if, for that reason, already each of his works is a valuable legacy for coming generations,—we shall also, in his investigations regarding the formation of the crust of the earth in the Old World, be filled with admiration, in perceiving in Alexander von Humboldt, in unison with the most exhaustive studies of innumerable sources of information,—a comprehensive acquaintance in all departments of human knowledge; we shall regard with increasing interest the rare and wonderful talent which enabled Humboldt to comprehend the mutual penetration of all branches of physical science, and the unexpected simplicity in which he presents these facts, together with the everlasting influence which nature exercises upon the life and the destiny of peoples."

But Humboldt did not restrict himself to the investigation of those laws which governed the creation of this world, and which still regulate its existence, exclusively;—man became also to him an object of observation and meditation.

He learned to know the various tribes of America; and followed the traces of their culture. Thus Humboldt acquaints us with the ancient inhabitants of Mexico and Peru. He made himself intimately acquainted with the condition of these peoples in the Spanish colonies, inasmuch as he could represent their commerce, their mining, their agriculture, their political constitution, their missions, — nay, more, even their peculiar diseases. Humboldt likewise originated another important undertaking, which had for its object to bring the great scenes of nature of the mountain-chains of the Andes, and the memorials of the departed civilization of the aborigines of Central America, before the eyes of Europe in a series of pictures. For the first time appeared in Europe landscapes which, with the artistic conception of a country, united a most faithful representation of nature, and speedily banished, in the higher circles of artistic taste and education, all illusive landscapes; and originated the historical landscape-painting which, especially through Rugendas, and other German and foreign artists of our days, has attained to such great perfection. In the opinion of Alexander von

Humboldt, landscape-painting gave an important and characteristic impulse to the study of nature. The epoch of the greatest landscape-painters was, as well known, the seventeenth century. In that period lived Claude Lorrain, the successful painter of light ; Ruysdael, great in dark forests and threatening clouds ; Gaspar and Nicolas Poussin, in representing heroic forms of trees ; Everdingen, Hobbema, and Cuyp, in faithful representation of nature. Humboldt considered it a higher step in representing individual forms of nature, which could, however, only be accomplished when our geographical knowledge, through travels in foreign climates, became more extended, and the ideas of classification and the conception of beauty more elevated and perfected. We now arrive at the period when single forms of exotic plants, fruits, branches, and blossoms were painted. In this department we recognize John Breughel, the painter of the individual character of the torrid zone ; Franz Post, of Harlem ; Eckhout, and others.

Although Alexander von Humboldt had accomplished an amount of labour in the earlier period of his life which was rarely equalled,

certainly never surpassed, he did not rest in his latter days from the labours of his very eventful life; the latter years belong to the great impulse he gave to the mathematical investigation of the laws of the earth-magnetism, for which he had prepared the way, by his former observations regarding the oscillations of the magnet-needle. In order further to illuminate this but dark territory, he encouraged, by his name, his influential position, and his scientific counsel, the learned men of all nations to an united effort in search of the laws of the earth-magnetism, and to indicate the changes of physical instruments hitherto used in the service of meteorology; and he originated, in furtherance of the physical sciences in general, the erection of numerous—one corresponding with the other—magnetic observatories, which now, like a great network, are spread over all parts of the earth; and in the desert of Siberia, and in Pekin, formerly closed to all science, these observatories may be found. His fame and influence became so great, that when Russia and England had made great sacrifices, in furtherance of science, and the accomplishment of Humboldt's plans, not only the Pasha of Egypt, but also an Indian prince, offered to increase the number of these magnetic observatories,

and thereby to honour Humboldt and science.*
We may well apply the words of a modern poet
to the great savant:—

“I am become a name ;
For always roaming with a hungry heart,
Much have I seen and known ; cities of men
And manners, climates, councils, governments,
Myself not least, but honour'd of them all !”

Through Alexander von Humboldt a whole world is opened to the view of the educated classes. One may see him upon the summits of the Cordillera and the Altai, and penetrate into all open fields of nature ; into the depths of the seas, the immense space of the heavens ; a seer and a prophet. In the marvellous results of his great activity, he appears a scientific sun, whose rays illuminate the whole earth, giving everywhere light and encouragement to scientific researches. In following the great explorer to another field of intellectual

* The discoveries of Oerstedt with reference to electromagnetism, and the results of the observations of Arago and Faraday, intimately connected with this subject, materially aided the investigations of Baron Humboldt. Oerstedt discovered that electricity in the vicinity of a body which acts as a conductor of electricity, produces magnetism ; whilst Faraday remarks that, on the contrary, liberated magnetism would also occasion electric flows.

culture, from which he had obtained, through his life-long studies, valuable information, we meet him in the history of the physical aspect of the universe, the knowledge of the gradual development and extension, regarding the unity of all forces of nature. This is at the same time a part of the development of the human mind in general; for the endeavour of humanity to become acquainted with earth and heaven, to comprehend the united activity and actual co-operation of the great forces of nature, in both spheres, is, in its origin, perceptible in the most primitive endeavours of peoples. Beautiful are the words of Göthe :—

“Wie Alles sich zum Ganzen webt,
Eins in dem Andern wirkt und lebt,
Wie Himmels-Kräfte auf- und niedersteigen,
Und sich die goldnen Eimer reichen !”

The consideration of the phenomena of nature, and the laws of evolution, have been recognized, by the more educated portion of the human race, in the earliest periods of human history; and the gradually extended and developed insight in nature, and the continuity of all forces in the universe, advanced always side by side with the history of the moral culture of human kind. It commenced like all other

knowledge; this first perception of nature, with isolated objects, and the presentiment of the internal combination of phenomena, as a whole—a cosmos. Only in a more advanced stage in the development of the mental life of mankind, this mere presentiment of the absolute unity of all things and all phenomena became a recognised fact. The intelligent imagination of a Plato, a Columbus, and a Kepler pointed to the goal which exact science subsequently reached in different ways. This gradual consciousness of humanity has been the means by which the ideas of the unity of all phenomena in the universe became possible and more extended. This result is due, according to Humboldt, first, “to the independent efforts of the human mind to perceive and comprehend the laws of nature, to the contemplation of the phenomena of nature;—secondly, to the historical events, which suddenly expanded the horizon of observations;—and, lastly, to the invention of telescopes, microscopes, and instruments for scientific observations in general. These new and improved organs brought mankind not only in closer connection with various objects of the earth, but with the remotest space, and perfected and multiplied our physical perceptions.”

From these three separate points of view, regarding the causes of the development of physical science, Humboldt proceeded in the study of its history. He considered the gradually extended acquaintance with nature to be the cause of the exertion of the human mind ; he examined the results of the achievements of the ancient Greeks in this department ; to him the historical events appeared sudden means, in order to extend and to accelerate the progress of natural philosophy, more especially with reference to the condition of those peoples who once inhabited the shores of the Mediterranean. His method of profound and thorough research led him to consider the voyage of Colæus of Samos beyond the Pillars of Hercules ; the expedition of Alexander to India, the universal conquest of the Romans, the propagation of Arabian culture, and, subsequently, the discovery of America, &c. He perceived the decided influence which these events exercised upon the condition of nations ; and here he recognized the great importance of languages, which were the medium of the intercourse between the various tribes, separated from each other by considerable distances. The mutual comparison of these languages enabled him not only to ascertain their formation, but

likewise the degree of their relation, which materially assisted and accelerated the study of the various races of mankind.

In all investigations of Alexander von Humboldt, for the purpose of leading to more general aspects, it was his favoured method to select a given point, and to start from it in an exact manner onward. This circumscribed point, accessible to physical observations, he found in the basin of the Mediterranean Sea, which was surrounded by those peoples who laid the foundation of the subsequent civilization in the West. From this basin of the Mediterranean Sea he followed the stream of civilization, and found that the history of natural philosophy proceeded in an exact line of development, not emanating from one but several primitive races; for we discover in the earliest periods, as it were several points of light on the extreme horizon, from which the rays of civilization emanated,—Egypt, Babylon, Nineveh, Cashmir, Iran, and China. Humboldt observed on that occasion,—“These central points remind one of the greater of those sparkling stars in the firmament,—of the everlasting suns in the immeasurable space of the heavens, the power of whose rays we may perhaps know, but not, with the excep-

tion of a few, their relative distance from our planet."

In pursuit of the exact method of investigation in the selection of the Mediterranean Sea as the point from whence he started, with the history of physical science, Humboldt noticed likewise in the Mediterranean three separate and smaller basins, one near the other,—the *Ægean*, *Ionian*, and the *Tyrrhenian*. He discovered in these forms of the Mediterranean, three times contracted, the great influence both upon the earliest limitation and earliest extension in the exploration of the Phœnicians and the Greeks; he pointed out the important influence of the physical form of the sea-coasts upon the process of events, the direction of voyages, the changes in the supremacy of the sea;—all assisting to develop and expand our ideas; he followed the historical traces of the primitive civilization of the Hellenes; their navigation in a north-eastern direction, caused by the expedition of the Argonauts to Colchis;—southward in consequence of the Ophir voyages; westward through Colæus of Samos, and his campaigns under Alexander the Great; all these events opened new roads to civilization, and extensive parts of the earth became by conquest, and in consequence of the dissemination

of the Greek language and literature, new fields of operation. Greece aided materially the intercourse and the mixture of the peoples from the Nile to the Euphrates, from the Jaxartes* to the Indus. The physical aspect of our earth became, through extended observation of nature, and the intercourse with ancient civilized and commercial nations, suddenly accelerated and more general. Humboldt followed the progressive traces of the advancement in natural science, under the reign of the Ptolemies, after the dissolution of the great Macedonian empire, and the intercourse of Egypt with distant countries; the explorations in Ethiopia; the hunting of the ostrich and the elephant, the menageries in the royal houses of Brachium, &c. All these events assisted the progress of natural science; all contributed to the increasing stock of information. Humboldt directs here our attention to the establishment, about that period, of the museum of Alexandria, and of two collections of books, as the result of the practical appreciation of science, the importance of comparative observations, and the more general dissemination of the scientific achievements of that

* The modern river Syr Daria.

period. It was the age, as Humboldt observed, of encyclical learning, the combination of geographical and astronomical progress, of a better acquaintance with the motions of planets, though with regard to the knowledge of the absolute size, the form, the matter, and physical constitution of the globe, they remained stationary.

In the great Roman empire, Humboldt perceived the first union of the three basins of the Mediterranean before mentioned, together with other extensive territories, under one government. He fully appreciated the influence of the union of many states under one rule upon the progressive advancement of science, because the isolated channels of culture and civilization here converge. Rome became the centre of this new great circle; commerce by land advanced geography; Strabo and Ptolemy became the recognized guardians of geographical and of mathematical science; mathematical optics and chemical science commenced; and Pliny made the first attempt of a physical description of the globe. Strabo, a native of Amasia, in Cappadocia, in the year 20 A.D., became the author of the first work on geography, in 17 volumes—the result of previous and extensive travels. The seventh volume

of this work is incomplete. In the collection of his material, he carefully used all former tradition and the resources of the older literature. Not only in a scientific, but also in an historical point of view, this work is of considerable importance, and was held in high esteem during the Middle Ages. The first Roman to whom the honour is due of having collected the accounts of all previous travellers, and whose work is distinguished not only by an acquaintance with the subject in question, but by superiority of style, was Pomponius Mela, 48 A.D., a native of Spain. The older Pliny, 23—79 A.D., devoted in his *Natural Philosophy* a considerable part—four volumes—to geography, and furnishes some very interesting notes, characteristic of the Roman, regarding the west and the north of Europe, and of India.

In the introduction of Christianity, Humboldt recognizes the cause of the gradually developed conviction of the oneness of human kind,—the important source of humanity,—the humanizing of peoples in their manners and organizations. Having regard, with reference to the development of a more perfect knowledge of the unity of nature, to the four principal events : 1. The attempts to proceed from the basin of the Mediterranean eastward to Pontus and Phasis,—

southward to Ophir and the tropical gold regions,—and in western direction beyond the Pillars of Hercules into the ocean; 2. The Macedonian campaign under Alexander; 3. The age of the Lagides,—of Alexandria; and 4. The great Roman empire. Humboldt recognized another powerful influence in the invasion of the Arabs, who introduced a foreign element into European civilization; and further, the discoveries of the Portuguese and Spaniards six or seven centuries afterwards. These events gave a characteristic impulse to the advancement of physical and mathematical science, to geography and astronomy. “From that period on,” said Baron Humboldt, “the spread of cosmical science no longer depended on isolated political events.”

The Arabs, a Semitic primitive tribe, not only opposed barbarity, but re-opened the sources of Greek philosophy, and new roads to civilization. Humboldt, who showed in such a genial manner that the destiny of peoples, independent of their intellectual capacities, is also in a great measure determined by a variety of external conditions, the soil, the climate, and their relative distance from the seas, recognizes furthermore, in the peculiar form of the Arabian peninsula, an important cause of the great

intercourse of this people with the world ; and lastly, the natural propensity of the Arab to enjoy an uninterrupted intercourse and intimate acquaintance with nature and her powers, all these facts exercised an important and beneficial influence upon the progress of science. The Arabs cultivated, above all, physics and chemistry ; and in the latter branch of science they created a new epoch.

The age of the oceanian discoveries — the fifteenth century—directed all intellectual activity to one common end. The Middle Ages and their scientific acquisitions came to a close ; a new period was inaugurated. The western hemisphere of the globe was opened ; the first ineffectual attempt to discover America in the eleventh century became through Columbus a new field of civilization. Humboldt dwells with peculiar interest on this event and its consequences, because he became, in contrast to Columbus, the geographical discoverer, the scientific explorer of America. (Compare Humboldt's critical investigation relative to the historical development of geographical science of the new continent, and of nautical astronomy in the fifteenth and sixteenth centuries.)

Humboldt was engaged even down to our own days with astronomic-mathematical geography,

which science, perhaps, made in no period more important progress. He opened new avenues in this branch of science, in consequence of his scientific discovery of America. He likewise accelerated its progress, in animating and encouraging other able men to investigate this special department. It is, indeed, impossible to estimate the influence Baron Humboldt wielded, in advancing, not only directly but indirectly, the cause of science. His own researches in this department made him more intimately acquainted with the geography of America, and with the history of nautical astronomy in the fifteenth and sixteenth centuries. The fifteenth century, in consequence of the discovery of a new world, became, so to speak, the multiplier of the works of creation; and brought within the scope of the old world a great multitude of new objects, which necessarily caused *peu à peu* a change in the condition and the ideas of Europe. This period had for Baron Humboldt a special interest; for, with the discovery of America, mankind had made a most important step in the advancement of intellectual and material progress; new roads of intercourse and a more comprehensive view into a new nature were thereby opened. Perhaps no one was better qualified to estimate

and trace the history of these grand and courageous explorations than Alexander von Humboldt. Had he not, also, set out first from the shores of Spain into the great ocean? Had he not visited the same parts where Columbus first set foot upon the new continent?

The discovery of the western hemisphere opened likewise new fields for astronomy. The conquests of Columbus in geography were contemporaneous with the discoveries of Copernicus in astronomy. The use of improved telescopes expanded the circle of human penetration into immensity.* Kepler discovered the mathematical laws by which the planets are balanced in space, which had been anticipated by Copernicus; and lastly, the great science of gravitation, discovered by Newton, changed physical astronomy into a mechanism of the heavens.

* "Our range of vision has been in this way immeasurably enlarged by the telescope and microscope: ingenious acoustic instruments enable us to appreciate, to study, and record, sounds which could never be mastered by our unassisted ears: variations of temperature, electricity, are now made sensible to observation by delicate contrivances, long before our unassisted senses could take any note of such changes."
—Prof. H. Hennesey's Essay, *Science and Civilization*.

We cannot accompany Humboldt in his description of the history of astronomy, from the time of Galileo to Kepler, and the mathematical epoch, from the time of Newton to Leibnitz, because he was here less individually active, and only represents the results of his predecessors, in the exact manner, order, and place. He was, however, intimately connected with all discoveries of his contemporaries; for in every scientific conquest he was either an individual pioneer, or else he assisted and encouraged the attempts of others. Hence his valuable co-operation in furtherance of geography and astronomy, in cosmical science in general, is conspicuously manifested in the important departments of heat, light, magnetism, and all the more active and important forces of the universe, whose more intimate recognition is the intellectual triumph of our days.

To those who have profoundly studied the history of science, and are therefore familiar with the general progress of human events, and the particular achievements of Alexander von Humboldt in all its branches, I ought to offer some apology for many of the foregoing general accounts of Humboldt's position as a man of science in the world of knowledge, before I

proceed to give a short sketch of his personal history, his position as a man in the world of men.

The noble family of the Humboldts came originally from the interior of Pomerania, where they possessed landed estates. The father of Alexander von Humboldt was major in a dragoon regiment, and, during the Seven Years' war, the adjutant of the Duke of Brunswick, who frequently sent him with verbal reports to Frederick the Great. He was lord of the manors of Hadersleben and Ringewalde, and rented subsequently the Castle Tegel, situated between Berlin and Spandau.

This little castle had been originally a hunting-box of the great Elector of Brandenburg; and even in the time of Frederick the Great a royal preserve was kept in the neighbourhood. Major von Humboldt selected this place for his abode after he had retired from public life, and had made considerable alterations and improvements for that purpose; but, alas! death called him early away. Lady Humboldt, his wife, was the widow of a Baron von Holwede, and a niece of the Princess Blücher. The issue of this marriage

were two sons; the elder, Carl Wilhelm, was born at Potsdam, June 22nd, 1767; the younger, Friedrich Heinrich Alexander, he who engages our special attention, was, as already stated, born in the year 1769, September 14th, at Berlin.

Both brothers spent a great part of their youth at this castle of Tegel, and their earliest impressions are intimately connected with this place. A mysterious, though by no means uncommon rumour, was connected with this residence. It is said that in the year 1797 a ghost haunted this castle. Professor Nicolai, of Berlin, delivered a lecture on the subject, before the members of the Academy; and Göthe, offended by his (Nicolai's) attack on "Werther," addresses the ghosts of Walpurgis in these words:—

"Ihr seid noch immer da? Nein, das ist unerhört!
Verschwindet doch! Wir haben ja aufgeklärt!
Das Teufelspack, es fragt nach keiner Regel,
Wir sind so klug—und dennoch spukt's in Tegel."*

During the lifetime of Major von Humboldt, this old castle was a place of great hospitality, and the rendezvous, not only of princes and high officers of state, but also of men renowned

* Göthe's *Faust*.

in literature and science. It appears that Göthe, in the month of May, 1778,—having accompanied his friend, the Duke of Saxe-Weimar, to a great military review in Berlin,—walked, one morning, by way of Schönhausen to Tegel, remained there to dinner, and returned by way of Charlottenburg to Potsdam. On that occasion he met two lively boys, ten and eight years of age, and could certainly not anticipate the subsequent intimate relation between himself and both brothers, especially the elder.

Their education fell in a period when, as already said, important changes were introduced into the system of education in Prussia. The method of Rousseau found a cordial acceptance by the ablest men of the day. Campe—before mentioned, who subsequently with Klopstock enjoyed a high reputation as a linguist—became the first private tutor of the brothers Humboldt. He soon relinquished, however, his appointment, and accepted the rectorship of the principal educational institute of Dessau, which was offered to him in consequence of his signal success as a teacher. He established afterwards a celebrated private seminary at Hamburg. In search of another tutor, Major von Humboldt appointed a young man only twenty years of age, and without

the renown of his predecessor, Campe, who had, nevertheless, awakened great hopes in the father, which were, as the sequel proved, abundantly justified. His name was Christian Kunth; and, though poverty had compelled him to discontinue his academical studies, he possessed, nevertheless, sound knowledge in Latin, German, and French literature, in philosophy and history. The relation of Kunth to his pupils, Wilhelm and Alexander von Humboldt, was of the most intimate and affectionate nature, — different from such relations in general; perhaps with but few parallels; and certainly difficult, if not altogether impossible, in England, even under the most favourable conditions. Kunth availed himself, in furtherance of his object, of all the means within his reach; and his success not only fortified the confidence of the parents, but awakened in the boys a pure and lasting love for their teacher and guide,—an affection and a confidence which, through all the various and eventful periods of their lives, never abated, but continued in an undiminished degree until death. When, in after-life, Alexander was engaged in his memorable explorations of distant lands, or when Wilhelm, the elder brother, mused upon the ruins of classical

antiquity, it was always their faithful former tutor and friend who managed in the interim the property of the brothers at home with parental care. Kunth endeavoured to assist and to satisfy the aspirations of his pupils after universality in knowledge, but did not for a moment overlook the necessity of a profound acquaintance with the separate branches. The former tutor, Campe, had inspired them with a love for languages and geography ; and Kunth made these branches an important auxiliary in their progressive acquaintance with general knowledge. Both brothers very early manifested their peculiar inclinations. The elder brother selected mental philosophy,—the study of the higher results of human intellect and feeling, and, of necessity, languages, the natural expression of these results,—the special field for his labours. Alexander, on the other hand, devoted himself more exclusively to the various branches of the physical sciences.

A sad calamity soon visited the family von Humboldt, in which Kunth had been tutor since 1777, in consequence of the death of Major von Humboldt, in January, 1779. The influence of the widowed Lady Humboldt became henceforth more conspicuous ; and the perfect confidence of this high-minded lady in

the tutor of her sons was so great that she granted him almost parental rights. The noble disposition of Madame de Humboldt swayed beneficially the whole family circle, and inspired her sons, whose progress was one of the most important objects of her life, with an enthusiastic love for herself. An eminent personage, whose influence upon the mental progress of both brothers is notable, became, soon after this sad event, the friend of the family,—a Dr. Heim, subsequently a most celebrated physician, and professor of the University of Berlin. His frequent visits to Tegel, probably occasioned by the illness of Major von Humboldt, are of importance; because he instructed, after dinner, on each of these occasions, both boys in the rudiments of botany, and explained to them the twenty-four classes of the Linnæan system.

Significant is a remark of Dr. Heim about this period; viz., that the elder boy, Wilhelm, without difficulty apprehended the given instruction, and almost immediately remembered the botanical names; whilst Alexander, eleven years old, experienced great difficulties,—a phenomenon which manifested itself on various other occasions, and made both Madame de Humboldt and the tutor, for a time, apprehen-

sive regarding the capability of Alexander for any studies whatever.

In the company of Dr. Heim, the young Humboldts made short excursions in the neighbourhood of Tegel, and witnessed together the annual review of Frederick the Great at Spandau on August 19, 1783. In the same year they removed to Berlin, in order to prosecute in the capital more advantageously their united studies. Wilhelm, the elder, was chiefly engaged with ancient languages. In general they had their lessons together, assisted by private tutors. Feeble health prevented Alexander from prosecuting his studies with the same vigour as his older brother, until, by degress, both his physical health and his mental capacities improved and developed. The brothers Humboldt were assisted in their studies by the ablest men of Berlin: their position and prospects were most favourable; and hence the first years of their youthful days in Berlin passed away in unmixed happiness. The love for their native country—characteristic of both brothers during their whole lifetime—manifested itself more prominently at this period. From their earliest childhood on, the picture of the great Frederick was presented to them, and with it the ideal reforms and actual

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conquests of Prussia. Not before they were about to leave Berlin, and to continue their studies elsewhere, the great king died, and they were spared the humiliating spectacle of approaching weakness, internal dissolution, and moral corruption, which subsequently visited Berlin.

Having pursued together their earlier studies, the brothers entered also at the same time upon their academical career. The neighbouring university of Frankfurt an der Oder enjoyed at that period a high reputation; and this and other reasons induced Madame de Humboldt to select this seat of learning for her sons. In the company of their friend Kunth they left Berlin in the year 1786, in the same year in which Frederick the Great died, and proceeded to Frankfort, with the intention to remain for two years. Here they prosecuted their studies with diligence and success, and removed in the spring of 1788 to Göttingen, much to the satisfaction of Alexander, who manifested daily his great predilection for the study of natural philosophy; for in Göttingen he would have an opportunity to meet a star of first magnitude,—Blumenbach, the eminent professor of physical science,—who, in a most brilliant manner, surveyed and classified the varied branches and domains of science. Here

he would likewise find Heyne, the successful professor of antiquity, and Eichhorn, the historian. At Göttingen, Alexander von Humboldt received likewise a new and lasting impulse through his acquaintance with George Forster, who had, as previously stated, accompanied, for the purpose of scientific researches, the celebrated Captain Cook on his second voyage round the world. Another two years' residence in Göttingen brought their academical career to a close. Alexander had pursued, during this time, with unceasing diligence, his physical, archæological, and philological studies, under the personal influence of celebrated men. They were now sufficiently prepared for active life, and their future career had been positively determined.

The outbreak of the French revolution about this time, made necessarily a more powerful impression upon the elder brother, Wilhelm, who had prepared himself for public life, than upon Alexander, who engaged in the more peaceful study of Nature, and her unerring and unchanging laws. He paid at this momentous epoch almost exclusive attention to physical science, to the extension of our geographical knowledge; and, encouraged and animated by his friend Forster, he meditated upon future Transatlantic explorations.

The renown of Werner, of Freiburg, an eminent geologist, attracted Humboldt's attention, and in pursuit of this important branch of the physical sciences, which became henceforth one of his favourite studies, he undertook, accompanied by his friend Forster, in the spring of 1790, a journey on the Rhine, to Holland and to England. On his return he published these first results of his own individual observations, in a little work, entitled "*Mineralogische Beobachtungen über einige Basalte am Rhein*" (Mineralogical Observations on the Basaltic Formation on the Rhine), endeavouring to establish the Neptunic origin of these rocks, which, he asserted, owed their formation to the great revolution of the waters of our earth.

Humboldt next applied himself to book-keeping, the study of mineralogy and botany, at an academy in Hamburg; and it is related that during the winter months of 1790-91, he often went out alone in search of those mosses which blossom during the winter season. His residence in Hamburg was of short duration. Anxious to prepare himself for his intended travels, he resolved to visit the celebrated mining-school of Freiburg, in order to study another important branch of science,—Geognosy,—the composition and formation of the

crust of the earth, under Werner, equally eminent in both branches, Geology and Geognosy. The short sojourn of Alexander von Humboldt at this mining-school, where he met with a former acquaintance, Leopold von Buch, an earnest student of botany, and other young men, all anxious to profit by the teaching of Werner, proved not only a most agreeable, but a highly beneficial period in his memorable career. After these elaborate preparations he appeared, at the commencement of the year 1792, not only in his social position, but took his place amongst the authors of his day. He received the appointment of Assessor to the mining and smelting department of Berlin, but relinquished it after a short time, in order to superintend some new mines at Bayreuth, in the capacity of Director-General of Mines in the principalities of Bayreuth and Anspach. In this new position he manifested great zeal in promoting public institutions of a scientific and educational character, anxious to improve the condition of the miners. He relinquished voluntarily this appointment in the year 1795. Although he was quietly engaged in realizing his great object—the exploration of distant countries—he found in his more immediate neighbourhood, his practical occu-

pation,—continual observation, and the production of a series of articles in divers German and French publications on scientific subjects,—abundant means to prove his efficiency as a naturalist.

Humboldt's most important literary production at this period appeared in the year 1793, entitled "*Floræ Freibergensis Specimen*," or "*Flora of Cryptogamic * Growths in the Environs of Freiberg*," the results of his observations in the mines of that district, especially with reference to the fungi, or mushrooms, which grow there; together with the Aphorisms of the chemical physiology of plants, which contain his observations regarding their irritability, the process of their nutrition, their colours, &c. It may be said that even now, after the remarkable changes in this branch of science during the last twenty-five years, Humboldt's opinion, confirmed by the clear and acute manner of his early observations, still deserves the highest consideration.

Every facility was afforded to Alexander von Humboldt in his scientific studies at home, and

* A name applied to a class of plants, such as ferns, mosses, sea-weeds, and fungi, in which the fructification, or organs of reproduction, are concealed. Etym.: *κρυπτος*, *kryptos*, concealed, and *γάμος*, *gamos*, marriage.

his position in that respect was most favourable ; yet he could no longer suppress his earliest desires to visit foreign lands, and engage in Transatlantic explorations. He resigned his public appointment in the year 1795, with the view of making some short excursions to Switzerland and to Italy, preparatory to his intended travels in more distant lands. He first visited Vienna; cultivated in that city the acquaintance of an eminent geognost, Freiersleben, and used a beautiful collection of exotic plants, which he found in the Austrian metropolis, in furtherance of his study in botany. In the company of a friend he left Vienna for Italy, with the intention of visiting more especially the volcanic regions of Naples and Sicily ; but was compelled, on account of the war, to restrict his researches to Upper Italy only.

About this time was announced the great discovery of Galvani, of that force of nature which has achieved in our days such signal practical results, and which is called, as well known, in honour of the discoverer, "Galvanism." Humboldt received this announcement with considerable interest, and followed and observed the influence of this power, in various subsequent experiments. His scientific labours received very sad interruptions

at this period. His mother, to whom he was most tenderly attached, had already suffered for a considerable time, from increasing infirmity; and in the early part of December, his brother Wilhelm communicated to him the sad news of the demise of their excellent parent on the 20th of November. This painful event, and the consequent regulation of their family affairs, caused a short suspension in his scientific labours, and the execution of his projected travels in foreign lands.

Alexander von Humboldt remained during this winter with his brother Wilhelm, who had chosen the university town of Jena for his temporary residence. Here he enjoyed renewed intercourse with his friend Freiersleben; and in the month of February received the visit of Göthe. His practical study of anatomy, which he had commenced some time previously, awakened a lively interest in his brother Wilhelm, and even in Göthe, who had frequent discussions with him on the subject of zoology. He likewise renewed his former experiments, commenced in Vienna, with regard to galvanism, and paid special attention to the laws of the irritation of the muscles, and the affinity existing in the nerves of living animals; and here he encountered a phenomenon of life, in many

points analogous to galvanism. The results of these observations and experiments he published in a work entitled "Ueber die gereizte Muskel und Nervenfaser" (the Irritated Fibre of the Muscles and the Nerves), furnishing new and important information regarding the effect of galvanic chains from animal substances. His interest in the phenomena of this power of nature upon living animals we find in his subsequent observations in South America, with reference to the peculiar operation of electricity in so-called electric fishes.

Much regretted by his numerous friends, Humboldt left Jena in the spring, engaged in the realization of his plans to visit the West Indies. Even Göthe had profited by the animating influence of Alexander von Humboldt during his short sojourn in Jena; for in a subsequent letter addressed to Schiller he said: "I spent my time with Alexander von Humboldt very pleasantly and usefully. My labours in natural philosophy have been, by his presence, again aroused from their winter sleep."

A variety of circumstances conspired to cause delay and disappointment in Humboldt's intended travels; and even a short visit to the south of Italy was frustrated on account of the war. For although the French had been

compelled to evacuate the south of Germany, in consequence of the victories of the Archduke Charles, the bold tactics of Bonaparte had gained many important points—the possession of the Adriatic provinces, and other victories in Italy—and forced the Austrian Government to negotiations, which, though considerably prolonged, effected no change in the fate of Italy.

In the spring of the year 1798, Alexander von Humboldt arrived in Paris, at the house of his brother Wilhelm, whose residence was the *point de ralliement* of all the higher educated Germans. Here he was informed of an intended expedition, originated by the National Museum, under Captain Baudin, in order to explore the Southern hemisphere. His desire of visiting unknown countries urged him to offer himself as a companion, even if compelled to defray his own expenses. Two naturalists had been already engaged to accompany this expedition in the interest of science—MM. Michaux and Bonpland. Humboldt's first object was to seek at once the acquaintance of these men. In the latter—Aimé Bonpland—he found a congenial friend. He was a young man, and one of the most distinguished pupils of the Medical School and the Botanical Gardens of Paris. The offer of Humboldt to accompany this expedition was

readily accepted, and he made all necessary preparations. He commenced to study the Arabic language, and animated his brother Wilhelm to the study of the multifarious languages of America. Humboldt became soon acquainted with the most celebrated naturalists and mathematicians of Paris; and here he continued his former researches regarding "the composition of the atmosphere," assisted by the celebrated physicist Gay-Lussac. He instituted eudiometric experiments, in order to further the "chemical analysis of the atmosphere," which he repeated in all kinds of weather, and in all seasons. Humboldt rendered important services to this branch of science. But already, at the commencement of his preparations for the contemplated expedition under Captain Baudin, he experienced new disappointments. Clouds arose on every side; the political horizon darkened. A renewal of the war in Germany and Italy was imminent, which caused the postponement of the intended expedition, because the French Government retained the funds granted for that purpose. He next proposed to accompany an expedition of French naturalists to the lower parts of Egypt; but this also became impossible, because, after the battle of Aboukir—which was lost by the French in an

engagement with the English under Nelson—the communication with Alexandria had been suspended. In the early part of the year 1799, Alexander von Humboldt, accompanied by Bonpland, visited Spain, in order to realize their intended departure to some Transatlantic country. But this journey served also as a scientific excursion. Humboldt, by the aid of his rare instruments, was enabled to ascertain the height and astronomical position of many important points. He ascended the high Dentelles of the Montserrat, and ascertained the exact height of the central plains of Castile; whilst Bonpland examined the world of plants, and secured rich treasures. Soon after their arrival in Madrid, circumstances assumed a more favourable aspect. The ambassador of Saxony, M. de Forell, evinced a lively interest in Humboldt's plans, and presented him and Bonpland to the intelligent Spanish Minister, Don Mariano Luis de Urquijo, by whose influence Humboldt obtained an audience from the Spanish Court, at Aranjuez. Here he had an opportunity of explaining to the King the scientific reasons for his contemplated travels, and also the material benefits of his probable discoveries. He was so fortunate in his representations, that the King of Spain expressed

his entire concurrence in Humboldt's plans, and granted him the rare permission to explore, without any hindrance, the Spanish territories of America; whilst the minister offered his influence in giving effect to this permission. Rejoicing at the sudden change of their prospects, they left Madrid in the month of May, in order to reach the harbour of Corunna.

On their arrival in this harbour, a new obstacle presented itself. The English had blockaded it, in order to cut off the communication of the mother country with her American colonies. Both travellers had been furnished with letters of introduction from the Spanish Secretary of State to the commander of the harbour of Corunna, Don Raphael Clavigo, who endeavoured to make their sojourn as agreeable as possible, until the blockading English frigates should clear the port. The corvette *Pizarro*, lying in the harbour, was destined to proceed to Havana and Mexico, but had been likewise detained in consequence of the blockade. The officer Clavigo advised Humboldt to embark in this corvette, and await a favourable opportunity to reach the open sea. This advice was accepted by the travellers, and as they were not only very anxious with regard to the safety of their instruments, but wished also, if possible, to ex-

plore the island of Teneriffe—Clavigo instructed the captain to secure the former and to land at the island, and wait until the travellers had visited the harbour of Orotava, and ascended the Peak.

At the moment of embarkation Humboldt wrote a letter to Captain Baudin, reminding him of his former promise, that if the delayed French expedition should take place, and he took the road round Cape Horn, he would meet him either at Montevideo, Chili, or Lima, or in whatever part of the Spanish colonies he might be. In consequence of a severe storm, the two English frigates and a line-of-battle ship, which blockaded the harbour of Corunna, were compelled to leave the coast of Spain, and seek for a while the more open sea. The Commander Clavigo urged the travellers to seize this favourable moment. Humboldt and Bonpland speedily brought their luggage on board, and embarked in great haste; but had, in consequence of the increasing western gales, to contend four days with the elements. At last they succeeded, unobserved by the English cruisers, in leaving the harbour. They passed the lighthouse near Corunna in the afternoon of the 5th of June, and reached towards evening the open, boisterous sea. Who can describe

the feelings of Humboldt when, at a late hour of this summer day, he saw the realization of the hopes and wishes which he had nourished for nine years, and in which he had been so frequently disappointed! — what were his thoughts on that evening, about nine o'clock, when he perceived the light from the hut of a fisherman of Sisargo — the last visible object of the western coast of Europe—which in the continually increasing distance mingled with the light of the stars which now appeared in the horizon. His and Bonpland's eyes were involuntarily directed to this phenomenon. Humboldt observed many years afterwards, in relation to this event: "These impressions can never be obliterated from our memory! How many memorials of the past are brought before our imagination, by even a single illuminated spot, which appears in the midst of a dark night, alternately above the moving waves, indicating the shores of our native land."

The travellers passed the small Canary islands, whose conical rocks and volcanic eruptions engaged their attention, and which besides offered many interesting sea-plants. Their captain mistook a basalt-rock for a fortress, and despatched one of his officers to the spot. This gave Humboldt and Bonpland an oppor-

tunity to set foot on the little island La Graciosa,— the first ground they touched which was not European. Humboldt's sensations on this occasion are thus expressed : — “ It is impossible to describe adequately the feeling which possesses the naturalist who for the first time stands on entirely foreign ground. Our attention is attracted by such a variety of objects, that it is difficult to account for the impression produced. At every step we expect to discover new products, and under the influence of these thoughts, we often fail to recognize those plants which are the most common in our botanical and historical collections.”

Humboldt expected to see the celebrated Peak of Teneriffe from a considerable distance, but found it enveloped in a dense fog. This rock is not always covered by snow, and is surrounded near its summit by large blocks of black lava, and a vigorous vegetation; and hence is less visible at a great distance.

Humboldt and his companion Bonpland, on their arrival at Santa Cruz, received from the Governor, in consequence of their recommendations from the Court of Madrid, immediate permission to explore the island. They set out on their tour the very day of their arrival, because, on account of the English blockade,

their ship could only remain four or five days in the harbour. They hastened, in order to reach the harbour of Orotava, and intended to engage from thence a guide to the peak. It was the most important object of Humboldt to examine this rock. A very charming road conducted the travellers from Laguna, a city 1,620 feet above the level of the sea, to the harbour. They traversed a country of matchless beauty. Enchanted by this magnificent panorama, the travellers reached Orotava, and proceeded from thence through a splendid grove of chestnut trees, towards the summit of the volcano.

Perhaps no part of the globe was more calculated to increase Humboldt's desire for travels, to elevate his thoughts, and cheer his spirit, than these first tropical sceneries. No wonder that the naturalist Anderson, who accompanied Captain Cook on his third voyage round the world, recommended this island to all the physicians of Europe, as pre-eminently fitted for invalids of every kind, calculated to infuse into sinking hearts and feeble limbs—by virtue of its genial climate, and the ever-green picture of a most luxuriant vegetation—new hope and new strength. His picture is certainly not overdrawn. Humboldt calls it an enchanting

garden, and himself experienced the powerful influence of this great panorama, being highly susceptible to the sway of nature's beauty,* though it is possible that in the eyes of the geologist this island is only a rock of interesting volcanic formations, indicating different geological epochs. Humboldt and his companion instituted highly interesting observations regarding the formation of the Peak of Teneriffe, its geological history, and the variety of vegetation by which it is surrounded. Here he arrived at most important general conclusions; viz., that the inorganic forms of nature — mountains and rocks — maintain a resemblance in all parts of the earth; whilst the organic forms — plants and animals — always differ from each other. The rocks, perhaps older than the causes of the climate, appear alike in both hemispheres. Humboldt recognised the difference in plants and animals — depending on climatic conditions, and their elevation above the level of the sea. He made very interesting investigations with reference to the geographical distribution of plants and animals,

* "Whom nature's works can charm, with God himself
Hold converse; grow familiar, day by day,
With his conceptions; act upon his plan,
And form to his the relish of their souls."

Dr. Percival.

and his subsequent extensive examinations in other parts enabled him to originate the new science, "The Distribution of Plants and their Laws." The remarkable powers of observation of von Humboldt enabled him already, on the noted Peak of Teneriffe, to recognise the important influence of various heights upon the distribution of plants and animals. He continued his geological observations on the opening of the volcano with signal success. Here he collected new materials for his subsequent view and interpretation of the volcanic agency in the formation of the solid earth, and the phenomena of earthquakes.

A sudden glance from their high elevation upon the sea and along the coast, convinced the travellers that the *Pizarro* was ready for departure. With considerable anxiety they hastened from the mountain, in order to reach the ship with all possible speed.

Humboldt obtained from this first and short excursion on entirely foreign ground, important scientific lore, in furtherance of his future explorations. The group of the Canary islands had been to him a valuable book, the variety of whose contents, upon a very circumscribed space, must necessarily conduct a mind like Humboldt's to a further and more general in-

sight into Nature's laws. He recognised intuitively the true object of the naturalist, and the importance of special observations. The ground which we traverse in joy and in sorrow is subject to constant and unceasing changes, and displays in its evolution a marvellous activity in the process of destruction and reproduction; it is possessed of a power which regulates and shapes the chaotic—rivets the planet to its sun—infuses into the cold and lifeless mass the animating breath of heat, and shatters the apparent complete and perfect, and places new and different forms upon the ruins of the former. What power is this? How does it create and destroy?

These were the next and most important problems which forced themselves on Humboldt's attention, and to the scientific solution of which he had devoted his life. "What is a day of creation?" he exclaimed; "will a turn of the earth round its own axis suffice?—or is it the result of a series of millenniums? Did the solid earth first rise above the waters, or did they recede to the interior of the earth? Was it the force of water or of fire which caused the elevation of the mountains, levelled the plains, and marked the limits of the sea and the land? What are vol-

canoes? How did they originate, how do they operate?"

The island of Teneriffe offered to Baron Humboldt the first practical reply to these important questions. Here he became thoroughly convinced of the soundness of that principle which underlies all his researches; viz., to regard all isolated bodies only as a part of an inseparable chain, ranging throughout all parts of nature, the result of general great causes and effects; to discover the thread of unison in the apparent labyrinth of infinite multiplicity; not to regard with indifference the seeming small, but learn to perceive the great in the small, the whole in the part. In this sense the volcano of Teneriffe became to Humboldt a key to the great secrets of the united life and activity of our planet. He apprehended the various means which Nature employs in order to construct and to destroy; the history of a part afforded the means to solve the history of the whole. The fire of the volcanoes which he examined in the island of Teneriffe had been long extinguished, but the remaining traces became to Humboldt large letters, enabling him to comprehend the mighty element which once pervaded our earth, penetrated its crust, buried men, animals, plants, and cities, by means

of earthquakes; and which still permeates its veins in the interior of the earth, in order to shake here and there violently the ground, or discharge, by means of its ventilators, the mouths of volcanoes, flames and burning lava. This is what Baron Humboldt taught us.

On his further voyage towards Central America, Humboldt witnessed a beautiful and sublime sight, in the night of the 4th to 5th of July, under 16° latitude, the sparkling constellation of the southern cross. At this first sight of the phenomenon of a new world, he saw, with deep emotion, the realization of the dreams of his early childhood. What he felt at this hour of his memorable life, he discloses in his own words:—"If we commence to cast our eyes on geographical maps, and peruse the accounts of travellers, we are inspired by a love for certain countries and climes, for which, in riper years, we can scarcely account. These impressions influence, very materially, our decisions; and we endeavour almost instinctively to come in close connection with those objects which had for a long time a secret charm for us. When I commenced to study astronomy, I experienced a fear unknown to persons who lead a sedentary life. It was painful to me to renounce the hope of seeing the beautiful constellations near the

south pole. Impatient to explore the territories of the equator, I could not raise my eyes towards the starry sky without thinking of the southern cross and the sublime passage of Dante :”—

When to the other pole mine eyes I turn'd,
And there beheld four planets on the right,
By none save those in Paradise discern'd :
Heaven seem'd to view their lustre with delight.
O northern region, how bereaved art thou,
These starry splendours banish'd from thy sight ! *

The hitherto prosperous passage of Humboldt and his companion assumed an alarming aspect in consequence of a malignant fever which seized several of the passengers, and increased the nearer they approached the Antilles. Those still preserved from infection resolved to leave the ship at the first opportunity, and continue their journey by the next vessel sailing their way. They persuaded the captain to land his passengers at the harbour of Cumana, on the north-eastern coast of Venezuela. This circumstance caused a change in Humboldt's plans, and induced him, for the first time, to visit the coasts of Venezuela and Paria, still but little known, and to continue afterwards their journey to

* Dante, translated by J. C. Wright, M.A. Fourth edition : *Purgatorio*, p. 150, 19—25.

New Spain. They left the ship at Cumana, and thus the accidental disease became the more immediate cause of the great discoveries of Humboldt in these territories—on the Orinoco to the confines of the Portuguese possessions on the Rio Negro.

The forty-one days which occupied their passage from Corunna to Cumana enabled both Humboldt and Bonpland to make important observations relative to the temperature of the air, based on the material which science had already afforded them. Another very interesting phenomenon engaged Humboldt during this voyage,—viz., the colour of the sky. He not only enjoyed the splendid changes of colours, from soft green to a beautiful yellow and red, as reflected in the sea, but he yielded involuntarily to the impressions which the azure above produced. He examined the cause and effect of this phenomenon, and became the first naturalist who instituted scientific observations upon the sea near the equator, with reference to the colour of the sky. Already, in 1765, Deluc called the attention of scientific men to the azure of the sky, and inquired into the cause and the condition of this phenomenon ; and, in 1791, Saussure invented an instrument, which he called “Cyanometer.” This instrument was

used by Humboldt on this occasion with considerable success, in ascertaining the degree of the blue, and the nature of those vapours in the atmosphere which are not transparent. At Cumana the travellers witnessed the traces of an earthquake which had taken place eighteen months previously. Humboldt examined the coast, the town, the fortress, and the vicinity. This place, frequently visited by earthquakes, afforded him the material for a thorough investigation of the volcanic soil. He studied the history of this phenomenon in order to obtain more correct views; to discover the direction and the expansion of these earthquakes, and to bring them under a yet undiscovered law. On the 9th August, 1799, the travellers made their first excursion to the peninsula of Araya, a place formerly noted for its slave-trade and its pearl-fisheries. They found, after the exploration of a forest of considerable extent, in the hut of an Indian family, a hospitable reception. Having spent two days in exploring these regions, they proceeded soon afterwards to the missions of the Chaymas Indians, a district of wonderful plants and animals, and a people still in their primitive condition. They passed through a district covered by trees of gigantic height and dimension.

“When,” said Humboldt, in describing this place, “a traveller finds himself for the first time in the forests of South America, he encounters most extraordinary and astonishing phenomena of nature. The environs are but little calculated to remind him of the description of distinguished travellers with regard to the shores of the Mississippi, Florida, and other temperate parts of the New World ; for here, in Central America, the traveller perceives at every step that he is not on the confines, but in the very heart of the torrid zone. It would be, perhaps, difficult to say which feeling dominates in the mind of the spectator of these magnificent scenes ; whether it is the awful silence of the solitude, the splendour of the various forms of nature, the vigour and luxuriance of the vegetation which distinguishes the climate of the tropics.”

What feelings must have been awakened in Humboldt at the sight of these varied and captivating scenes ! In this part he saw, likewise for the first time, the peculiar and artistic nest of the oriola, a bird related to the thrush, whose hoarse noise pierces through the forests, and surpasses the roaring of some considerable cataracts in the neighbourhood. He had also the advantage of becoming acquainted with the mode of life of the monks in these missions.

The old prior smiled at Humboldt's researches, his instruments, and the collection of dry plants ; all which he pronounced useless things, whilst he asserted " that, in his opinion, of all the enjoyments of life, sleep not excepted, nothing could equal a good piece of beef."

Humboldt explored the volcanic regions of these parts, visited the principal place of the mission, the Convent of Caripe, the other stations, San Antonio and Guanguana, and the cavern Guachoro, in the valley of Caripe. He was the first who acquainted Europe with the existence of this cavern ; in the interior of which, according to the tradition of the aborigines, the spirits of their ancestors dwell ; to them a sacred place, in which no one ventured to enter. The travellers reached the town of Cariaco, which they immediately left on account of a contagious disease, and returned to Cumana, where Humboldt continued his studies respecting the tribes and the languages of the Indians, with whom he had already become acquainted. His second visit to Cumana was characterized by more extraordinary events. It appears that Humboldt and Bonpland took their accustomed walk on the shores of the gulf, on the evening of October 27th, 1799, when they were suddenly attacked by a Zambo, a mixture of the

negro and the Indian, who aimed a mortal blow at Humboldt with a heavy club, which he fortunately evaded; whilst a second stroke aimed at Bonpland felled him to the ground. He arose with the assistance of Humboldt, and the very moment the Zambo attempted to meet the united self-defence of the friends with a large knife, Biscayan merchants appeared upon the scene, rescued the travellers, and captured the Zambo. Humboldt noticed, from the 10th October, a red vapour which covered the sky for some minutes each evening, and was soon succeeded by other remarkable phenomena of the air; the fog became more dense, the hot night-air smelled offensive, the usual sea-winds were absent, the sky assumed the colour of fire, violent eruptions of the ground occurred in divers places. These preparatory phenomena culminated, on the 4th November, in an earthquake,—a memorable afternoon for Humboldt, who, for the first time, witnessed this great phenomenon and shared its dangers. The impression which this event produced, and the manner in which he acquainted himself with its dangers, he records in these words:—
“From our earliest childhood we acquire a notion that the water is the movable, and the earth the immovable element. This early con-

ceived notion we encounter every day. A sudden violent shock of the ground dispels in an instant all former delusions. It is a sudden awakening, and a disagreeable one. We become convinced that the apparent quiet of nature has deceived us; henceforth the least noise arouses our attention, and, for the first time, we begin to suspect the safety of the ground upon which we have walked so long with unshaken confidence. A repetition of these shocks, at short intervals during several days, will again dispel the uncertainty; man gathers new courage and confidence, and becomes, by degrees, as well acquainted with the vacillating condition of the ground as the experienced mariner regards the violence of the waves which toss his ship to and fro."

Only a few years ago, when Humboldt, after the lapse of fifty years, recalled these events, he said: "An earthquake has something omnipresent in itself, whose influence we cannot escape. Even the lizards, which quietly live at the bottom of the rivers, run on that occasion, with a peculiar noise, indicating extreme fear, towards the forest. Everywhere, in the presence of this phenomenon, man stands on dangerous ground."

A third violent shock, on the same evening,

towards nine o'clock, accompanied by a subterranean noise, caused a state of great consternation amongst the inhabitants of Cumana. Many persons came in great haste to Humboldt and Bonpland, in order to ascertain if their instruments indicated further repetitions. The sublime spectacle of that afternoon must have exercised a marvellous influence upon Humboldt, if we consider the part of the world where this great phenomenon manifested itself, and the rare powers of description possessed by him who recorded this event. In an immeasurable height above, and with accelerated speed, the thunder roared, whilst at the same moment the earth was violently shaken; add to this the terror of the people, who filled the air with cries of despair and amazement. Watch the sequel to this terrible picture of the raging elements of destruction which convulsed the earth;—a magnificent sunset, upon an indigo-blue sky, lined with golden clouds, and illuminated by prismatic rays of colour; whilst in the interior of the earth a threatening noise accompanied a new shock.

On the 18th November, Humboldt and his friend Bonpland left Cumana, in order to make a voyage along the coast to Guayra, and remain to the close of the rainy season at

Caracas ; visit subsequently the extensive plains—Llanos,* near the Orinoco ; pass the mighty river south of the cataracts, and follow its course upward to the Rio Negro ; approach the frontier of Brazil, and return by way of Guiana—whose capital is called Angostura—to Cumana.

This was a journey of more than five hundred miles, two-thirds of which must be executed in boats. Furthermore, the districts to be explored were as yet unknown, and with the existing missions in these regions no commercial intercourse had been established. Courage and resolution, animated by a zeal for the advancement of science, were here, as always, the guides of Alexander von Humboldt. The unfavourable descriptions of the colonists, who represented to him in vivid colours the multifarious dangers incident to his intended journey, with reference to the ground, the wild beasts and savages he must encounter, did not daunt Baron Humboldt : he pursued with unfailing steps his great purpose. He reached safely the harbour of New Barcelona, near the mouth of the Rio Reveri, noted as a favorite abode of crocodiles. Here he observed from a hill the

* A vast plain of more than 16,000 square miles, without an elevation, and called by the inhabitants "Mar de Yerbas,"—sea of herbs.

level of the sea, in order to ascertain the geographical longitude of the place. He left on the day following, and his companions, fearing the danger of the small conveyance on a boisterous sea, resolved to continue their journey by land, together with Bonpland, who proposed to institute botanical researches. Humboldt, accompanied by a single pilot, crossed the sea to Guayra, whose harbour is a resort of sharks, and its environs more like a desolate rock than a continent. He remained only a few hours, chiefly on account of the ravages of the yellow fever, and reached, on the evening of November 21st, Caracas; whilst his companions, after a difficult journey in these inhospitable and damp regions, arrived four days later.

The sight of Caracas, a town which contained at that time above 30,000 inhabitants, and where Humboldt remained two months, awakened in him serious and gloomy thoughts. One might almost suppose that he had a kind of presentiment with regard to the fearful calamity which, in 1812, visited the place, when an earthquake buried 12,000 inhabitants under its ruins. Fogs descended nightly from the mountains, and enveloped the valley; the environs reminded Humboldt of the well-known "Harzgebirge" and its pine-

trees. The valley of Caracas, Humboldt calls a paradise—an abode of perpetual spring—where even in the night the temperature is not below 18° Celsius.

The more immediate object of Humboldt's scientific investigation was the Silla,* an important mountain, whose summit nobody living near its foot had yet been able to reach; and hence he experienced some difficulty in obtaining the necessary guides. The Governor, however, procured the assistance of a few negroes. On the day appointed for the expedition—January 22nd, 1800—sixteen persons assembled in order to accompany Humboldt and Bonpland. The exploit, which the guides hoped to accomplish in six hours, proved difficult, but rewarded abundantly the adventurers, by unfolding to them magnificent scenes of nature's beauty; but demanded also a considerable amount of courage and perseverance—unfortunately not possessed by all the attendants of Baron Humboldt; for they had scarcely proceeded half-way, when most of them were disheartened,—amongst them a Capuchin monk, who was a professor of mathematics, and had shown a considerable amount of

* Silla de Caracas, or Cerra de Avila—height 8,100 feet.

courage at the outset. He remained half-way in a plantation, from whence he watched, by the aid of a telescope, Baron Humboldt and his more resolute companions, who climbed with difficulty upward. At a height of six thousand feet they met still with pastures, covered by the blackberry-bush and little yellow flowers in the form of lilies. In vain did Humboldt hope to find a wild rose, of which he met not a single species in all his travels in South America, with the exception of the Montezuma rose, in 19° latitude, on the mountains of Mexico.

On the summit, Humboldt enjoyed, with his friend Bonpland, a magnificent view, similar to that which had met him seven months previously on the Peak of Teneriffe. From this elevation he surveyed a landscape of rare beauty, where a savage nature, not yet subdued by man and civilization, exercised undisputed sway over regions perhaps as extensive as the whole of France; a beautiful and wide solitude, usurped by a savage vegetation, wherein the voice of human joy and sorrow had never yet been heard. On the precipice of an abyss of eight thousand feet stood Baron Humboldt, enraptured by the sublime spectacle before him, until the evening fog and the approaching

night compelled the renowned travellers to descend. Having completed their observations, they reached, at ten o'clock in the evening, a ravine, where they had to pass a perilous road, in order to find a resting-place for the night in the rock, aggravated by the fact that their guides had secretly sneaked away, which compelled them to carry their instruments, they suffering at the same time from hunger and thirst.

We have more especially noticed these travels in order to show in Baron Humboldt that courageous perseverance which does not hesitate at the prospect of difficulties and dangers, having constantly one great object in view—the advancement of science and a more intimate acquaintance with the world. No distance could deter him, if the peculiarities of a country and its natural treasures required investigation; and hence he left Caracas, and wandered in the extensive plains, the Llanos, rarely ever trodden by human feet. For the same reason he did not choose the shortest road; because his finely organized perceptions of nature's beauty would not permit him to forego the sight of the splendid valleys of Apogua; his scientific zeal urged him to examine the more important parts of the mountain-chains near the coast;

descend the Rio Apure, which winds its way through these extensive plains to the mouth of the Orinoco. The same object brought him likewise to the warm springs of Mariara, on the luxuriant shores of the Valencia Sea, and the extensive pastures of Calaboza, in the eastern parts of the province Varinas, and to San Fernando de Apure, on the Rio Apure.

This journey conducted Baron Humboldt, during the month of February 1800, through the valleys of the Tuy, where he visited the sugar-plantations, the gold-mine, the noted zamang-trees, with their gigantic branches, the colonies at Hacienda de Cura, and the cotton-plantations near Cura; he examined the condition of agriculture in these regions, and subsequently reached the Sea of Valencia. Here he commenced important investigations regarding the decrease of the water of this sea; and discovered the cause in the destruction of the forests, the cultivation of the soil and of indigo, and likewise the dryness of the atmosphere.

In the environs of Mariara, Humboldt found also the lofty tree "Valador," whose winged fruits he, together with Bonpland, collected and transmitted to Europe, which now grow in the gardens of Berlin, Paris, and

Malmaison. He himself declared that the numerous trees now to be found in many hot-houses of Europe came originally from the one which he discovered near Mariara. On his return from Porto-Cabello, on the road to the beautiful valley of Araguay, Humboldt met, at a farm called Barbula, the celebrated cow-tree, whose remarkable qualities he had long doubted. Here he stood by the side of this tree, which, by a slight incision, yielded a sweet aromatic milk, and furnished the negro with a healthy kind of food. This tree deserves special notice in the memorable life of Humboldt; for he himself stated that, amongst the great number of remarkable phenomena he had witnessed in his travels, few made such a lasting impression upon him as the sight of this cow-tree, because everything related to milk and grain awakens in man involuntarily a lively interest, which has not alone its origin in the desire to become more intimately acquainted with nature and her productions, but which is interwoven with the general idea of mankind, that without milk and grain their existence would have been impossible. This is probably the origin of the religious veneration with which both ancient and modern peoples have ever regarded corn, and the animal which furnishes milk. The universal

notion that milk is only an animal production, must all the more forcibly strike us at the sight of a milk-yielding tree, whose existence had long been doubted. "Here," said Baron Humboldt, "are no beautiful forests, no majestic courses of rivers, no mountains enveloped in perpetual snow, which must powerfully impress us: the few drops of the juice of a plant remind us of the omnipotence and the fertility of nature. On the barren slope of a rock grows a tree, whose leaves are dry and tough, whose roots penetrate with difficulty the stony soil; for several months during the year no rain refreshes its withering leaves, its branches seem decayed; but if you bore the stem, a mild and nourishing milk flows from it. At sunrise this vegetable source is the richest, and the natives approach from every direction with large basins in order to collect the milk, which soon produces on the surface a kind of cream. Some consume their milk under the tree, others bring it to their children, and we fancy we see the assembled household of a shepherd distributing the milk of his flock." Humboldt relinquished his intended visit to the eastern issues of the Cordillera of New Granada, in order not to delay too long his voyage to the Orinoco. His chief object was now to discover

the connection of the Orinoco, the Rio Negro, and the Amazon. On the 6th of March he left, with his companion, the valleys of Araguay, in order to continue his journey through the desert, whose peculiar character, in contrast to the African desert, engaged his particular notice. Baron Humboldt traversed the pastures in these immense plains, covered by gigantic grasses, and here he noticed the breeding of horses and other cattle, which furnish an article of export for the harbours of the north coast. By way of Calaboza he continued his travels in the midst of the desert, the Llanos of Caracas, where he encountered a new and interesting object of observation—the electric fishes—*gymnotes*. He traversed this wilderness for two days without any indication of a road, and where the eye does not even meet a single object five inches high. Much to his surprise, he discovered a small society of Capuchins. On April 20, 1800, Baron Humboldt arrived with his attendants at San Fernando de Apure. He remained three days in that place, in order to examine the district so frequently visited by inundations—reminding us of the lower parts of Egypt—where the Orinoco and the Amazon, in consequence of a peculiar water system, find their natural connection. He sailed down the

Orinoco, rich in fishes, tortoises, &c., and on whose shores birds not unfrequently furnished their meal. In sight of any important object presented to his view, he took his notes ; to this he generally adhered, because in the face of the object under observation any such notice bears the seal of truth.

Humboldt proposed to sail down the Apure, and ascend the Orinoco ; and proceed subsequently to examine the Rio Negro. The brother-in-law of the governor of Varinas, Don Nicolas Sotto, accompanied Baron Humboldt on this expedition. The amiable character and cheerful spirit of this gentleman often banished from the mind of the naturalists the difficulties and dangers of this voyage. It is certain that any one less courageous would have shrunk from such an expedition ; for tigers and other wild beasts were not at all alarmed by the approach of the boat ; and crocodiles, 18 to 22 feet long, looked with confidence and unconcern on the travellers. The wild grandeur of nature, and the traditions which the negroes related with reference to this river, much interested Humboldt and his companions. A severe gust of wind and the awkwardness of the pilot nearly caused a fatal accident—the boat almost capsized ; the papers and other things belonging

to Humboldt were already under water; and in a remarkable manner the great explorer and his friends were preserved from a watery grave.

The Orinoco, though still about 194 miles from its source, is here very broad, and near Pararuma the pilot would not proceed further. Humboldt hired another ship from a missionary, and continued his journey on the upper Orinoco on the 20th of April. The difficulties and dangers they had to encounter were numerous and varied : first, the inadequate room of their ship; the fires they had to keep in the night, in order to chase away the jackals, who surrounded their resting-place; the oppressive heat; the troublesome mosquitoes; and other inevitable impediments, too numerous to relate. Baron Humboldt said, in retrospect of these days, "that only a naturally cheerful disposition, mutual kindness, and a soul alive and susceptible to grand scenes of nature's beauty, could vanquish such difficulties and privations."

An unusual rise of the river afforded Humboldt an opportunity of instituting observations regarding the condition of the waters. On his voyage on the upper Orinoco, the ship passed several smaller rivers—its tributaries; especially the greater Meta, which much resembles the Danube. They passed the city of Atures,

where Humboldt, besides the missions, visited the great cataracts,* which produced a lasting impression on his mind. This was the case also at the sight of the cataracts of Atures and Maypures, where the travellers remained five days. He visited afterwards San Fernando de Atabapo, and continued his voyage on the Cassiquiare, which in reality unites the Orinoco and the Rio Negro. At the little place called Atabapo a new route had been projected, at the suggestion of the principal of the mission in that district. Humboldt and his companions resolved, accordingly, to navigate first the river Atabapo, and follow afterwards the course of the rivers Temi and Tuamini. Baron Humboldt found himself suddenly in an entirely new country, and on the shores of a river whose name he had never before heard. He penetrated regions where man had scarcely left a trace of his

* "Cloud-girdled thunder ! embodied storm !
 Whether enrobed in vapours dark and dun,
 Or looms, magnificent, thy giant form
 Through the prismatic broidery of the sun.
 Wondrous alike ! what floods have swept thy brow
 Since the bold plunge of thy primeval wave !
 From whose tremendous advent, until now,
 Thou hast not paused nor failed. Yon boiling grave
 Roars from its depths the song creation gave."

Howison.

existence. Indians, man-hunters, inhabited these deserts, and caused frequent annoyance to the missionary stations. In these wild regions of America, Humboldt believed himself translated to that period when the earth became gradually inhabited. He appeared in these primitive regions a witness to the first formation of human society. The human beings with whom he here became acquainted knew no other object of worship than the forces of nature.

On the 6th of May Baron Humboldt reached the Rio Negro, noted on account of its serpentine course, after he had spent thirty-six days in a narrow boat, on a most perilous voyage. The rise of a single person from his seat, without giving due notice to the pilot, would have caused the boat to overturn. Although Humboldt suffered much from the sting of insects, the unhealthy climate and other inevitable difficulties had not injured him; and therefore, on his arrival at the isthmus of the Orinoco and the Amazon, he reviewed with satisfaction his past dangers and difficulties, supported by the assurance of having accomplished the most important object of this voyage, viz., that of determining astronomically the course of that arm of the Orinoco which flows into the Rio

Negro, and of confirming its existence, which had been for half a century both asserted and denied. Baron Humboldt's experience in these regions was of the greatest importance, for the purpose of rectifying the mistakes of existing maps.

Humboldt's feelings in sight of this region, in close approximation to the equator, are best expressed in his own words:—"In these interior parts of America we become almost accustomed to regard man as something non-essential in the order of nature. The earth is overburdened by a vegetation unrestrained in its process of development. Immense banks testify to the continual operations of organic forces; the crocodile and the boa rule the rivers; the jackal and other wild beasts rove without fear or danger through the forests. The sight of a luxuriant nature, in which man is nothing in comparison, is strange and saddening. Here, in a most fertile region, ever green, one searches in vain for traces of human activity, and believes oneself to be in a different world. These impressions become fortified in proportion to their duration."

Baron Humboldt visited the various Roman Catholic missions which are here dispersed; amongst others Maroa, and the still more southern fortress St. Carlos — the extreme

southern military post of the Spaniards, and scarcely two degrees from the equator. At this station he had the option either to descend the Amazon towards the coast of Brazil, or, on the river Cassiquiare and Orinoco, to reach again the north coast of Caracas. The latter route was chosen by him. The voyage on the river Cassiquiare was, independent of other difficulties, much aggravated by the presence of the mosquitoes, whose number increased the further they removed from the Rio Negro. He found only miserable Christian settlements on the eastern and the almost uninhabited western shore of the river. The human beings which he encountered ate with the same satisfaction the large ants which here abound as the Australians their spiders. But Baron Humboldt found here a still greater barbarity—the eating of human flesh. Only a few years before his arrival in these primitive regions, an alcalde, born here, had eaten one of his wives, having carefully fattened her. The protest of the Europeans against this detestable usage was of no avail. These different tribes looked upon each other as different beings, and claimed the same right to slay each other as they had to kill the jackal in the forest.

Baron Humboldt called this voyage on the

river Cassiquiare the most difficult of all his American expeditions. At last, having successfully overcome all obstacles, he and his attendants arrived, on May 21st, 1800, three miles below the mission Esmeralda, the current-bed of the Orinoco. The division of this mighty river Humboldt called an imposing spectacle; and in sight of the granite rock, 7,800 feet high, where the arms of the river divide, the remembrance of past dangers and difficulties dwindled away — he was amply rewarded, and science enriched, by most valuable acquisitions.

Here Baron Humboldt collected valuable information and important material for comparative hydrography. His general researches furnished most valuable contributions to the history of physical geography. In these regions he decided the physical relation of the soil, compared equal phenomena of the Old world with the condition of the soil in Central America, and gave to science an insight into the analogy of the process of formation in nature, and in the existing laws of our planet with reference to the structure of its water-veins.

At the mission of Esmeralda, Humboldt became acquainted with the noted poison called *curare*, prepared from the fruit of a plant of the same name. His experiments with this

poison proved that if it immediately mixed with the blood, in consequence of a wound, it would be deadly; whilst, taken internally, it was an excellent means of strengthening the intestinal parts.

Baron Humboldt positively established the union of the Orinoco and the Amazon; and achieved this scientific conquest, partly by means of his own penetration to the cataracts, and partly through the information obtained from soldiers from San Carlos, who had undertaken an expedition in order to discover the sources of the former river. This region was, before his time, entirely unknown, and to previous historians a pure enigma. The discovery of the sources of the Orinoco was reserved to a later traveller, Schomburgh,* who explored

* At the last anniversary meeting of the Royal Geographical Society, May 22nd, 1865, the President, Sir Roderick Murchison, commented in his obituary on the career of this extensive traveller, Sir Robert Hermann Schomburgh. "By his journey," said the President of the Royal Geographical Society, "across the interior, from the Essequibo to Esmeralda, on the Orinoco, he was enabled to connect his observations with those of his illustrious countryman Humboldt, who had always been his patron, and thus to determine, astronomically, a series of fixed points, extending across the watershed of the great rivers of Equatorial America. Humboldt was stopped at San Carlos, on the Rio Negro, but Schomburgh descended the mighty affluent

these regions in the interests of the Geographical Society of London.

The continued voyage on the upper Orinoco brought the travellers, May 3rd, to the eastern shores of the river, near "Puerto de la Expedition," where they examined the Cavern of Atarupe—probably the burial-place of a whole tribe which here perished. In a short period Baron Humboldt discovered six hundred skeletons, well preserved, and regularly laid out in baskets. He examined closely the peculiarities of these graves, and brought away some skeletons and skulls, which the natives very reluctantly removed. On a silent and beautiful night, Humboldt left this place of death—the place of the extinction of a whole tribe of Indians.

After a voyage of seventy-five days, during which time they had travelled three hundred and

of the Amazon to its junction with the Rio Branco, and returned to Guiana, by ascending the latter stream. During this remarkable journey, he made a survey of an extensive and previously unknown region. In the year 1840, M. Schomburgh received one of the Gold Medals of the Royal Geographical Society. During his researches in South America, he discovered and sent home the magnificent lily, *Victoria regia*, now so well established in Europe. Sir Robert Schomburgh died at Berlin on the 11th March, 1865."

seventy-five geographical miles, under considerable difficulties and dangers, and on five great rivers—the Apure, Orinoco, Atabapo, Rio Negro, and Cassiquiare—the illustrious travellers arrived in the middle of June, 1800, at Angostura, the capital of the province of Guiana.

After a short sojourn in this city, Baron Humboldt and Bonpland undertook an expedition, by way of St. Domingo and Jamaica, to the island of Cuba, in order to ascertain the geographical position of the southern parts of this island. They returned again to South America, explored the valley of Cauca, the river Magdalena, and the Cordilleras of Quindin, Choco, Quito and Peru. On June 23rd, 1802, the travellers arrived at the Chimborazo, and reached the height of 3,036 toises,* a height never before attained by any mortal.

In December, 1833, Boussingault—the only person, as far as I could ascertain, who again ascended this mountain—though he did not reach the summit, yet climbed four hundred feet higher than Baron Humboldt. The travellers explored subsequently the territory near the Amazon, of whose course Humboldt prepared a geometrical sketch. For the fifth time they

* 18,316 feet English.

crossed the high chains of the Andes, returned to Peru, ascertained the position of the magnetic equator, visited the rich silver-mines of Hualguayok, where silver is found 2,000 feet above the level of the sea; they examined the hot springs of Caxamarca, and the ruins of the ancient city of Mansiche, with its old pyramids, in one of which was accidentally discovered, in the early part of the 18th century, pure gold of the value of more than four million francs. Humboldt and his friend Bonpland crossed the western Cordillera of the Andes, and arrived at Truxillo, where they for the first time enjoyed the sight of the Pacific, surveying at the same time the long and narrow valley, noted on account of the entire absence of either rain or thunder. He explored the arid regions of the south coast of the Pacific, and arrived at Lima, the capital of Peru. Here he sojourned for several months, and instituted important climatic and astronomical investigations. Baron Humboldt examined a remarkably cold river on the coast of Peru; and in after-years, science, in recognition of the important services of the great naturalist, called the waters "Humboldts-Strömung."

The travellers reached, by way of Cuernaraca, and through the fogs of Guchilaque, the beauti-

ful city of Mexico. In January, 1804, Humboldt undertook a greater excursion in order to examine the eastern Cordillera of Mexico. The heights of the volcanoes Popocatepetl and Iztacchiuatl he measured trigonometrically; he also ascended the pyramid of Cholula, in consequence of the beautiful view it affords of the snow-covered summits of the surrounding mountains and the valleys of Tlascala.

Having finished these observations, the travellers visited Perote and Xalapa, where they passed through almost impenetrable forests of oak and pine. Humboldt succeeded, nevertheless, in measuring this district three times with the barometer; and in consequence of the results of these observations, a high road was made through these regions. His prolonged sojourn in this part, and the results of his numerous and varied observations, rendered valuable service to science. After other interesting investigations, Humboldt and his friend Bonpland arrived at Vera-Cruz, on the Gulf of Mexico, where they took passage on board a Spanish frigate for Havana, in order to take possession of the valuable collection which they had left there in the year 1800. Two months afterwards they departed for the United States of America, and, after a violent storm on their

passage, which raged for seven days in the canal of Bahama, arrived in Philadelphia.

During his short residence in the United States, Baron Humboldt—in contrast to his former investigations—made himself acquainted with the political institutions, and the condition of the people of these states, and returned, after an absence of five years, to Europe. In the month of August, 1804, the renowned travellers landed at the harbour of Bordeaux.*

The safe arrival of Humboldt and his companion caused unfeigned delight amongst their numerous friends, and more especially to the family of his brother Wilhelm, who occupied at that time the post of ambassador at Rome.

* Professor Agassiz—to whom Humboldt proved himself a kind and generous friend—is at this time pushing forward his explorations in South America. His party consists of four divisions, one of which has for its field the peninsula lying south of St. Paulo and between the Parana River and the Atlantic Ocean. The second division has the sea-coast extending from Rio de Janeiro to Bahia, and as far westward as San Francisco River. The third division has the interior, lying west of the San Francisco and between the tenth degree of south latitude and the tropic of Capricorn. The fourth division, at the head of which is Professor Agassiz himself, has for its tract the great valley of the Amazon, including its tributaries. This and the coast section are the most interesting, if not the most important, fields.

Madame de Humboldt, his wife, after a visit to Weimar, remained for some time in Paris, still hoping for the speedy arrival of Alexander, notwithstanding the many sad rumours concerning his fate. It appears that in the month of March of that year, Wilhelm received a letter from Havana, in which Alexander announced his immediate return to Europe. A rumour had been widely circulated that Baron Humboldt, shortly before his embarkation, had become a victim of the yellow fever, and though this news had not been confirmed, it produced in the family of his brother, at Rome, a considerable amount of excitement. We can, therefore, in some degree, imagine the surprise of Madame de Humboldt, when, in May, 1804, the news of the safe arrival of her renowned brother-in-law, together with his valuable collections, at Bordeaux, was communicated to the National Institute of Paris, and at once, through the kindness of the Secretary, transmitted to her. Equally great was Alexander von Humboldt's surprise to find, on his arrival in Paris, his sister-in-law, Madame de Humboldt, because he had not expected to see his brother and family before the commencement of the following year, at Rome.

Humboldt commenced, soon after his arrival

in Paris, to arrange, with the faithful friend and companion of his travels, the abundant material which had been collected. He received the co-operation of the most distinguished men of Paris, viz., Cuvier, Gay-Lussac, Arago, Vauquelin, Olmann, Laplace, and others. Nearly a whole year was occupied in preparation for the publication of his great work. In the spring of 1805 Alexander von Humboldt could no longer resist his earnest longing to see Wilhelm, and he left accordingly for Rome, with the intention to remain for some time. The house of Wilhelm von Humboldt was at this time the centre of a circle of the most eminent persons present in Rome, and the arrival of Alexander must have added very materially to its lustre. To witness the meeting, after a separation of some years, of these remarkable brothers,* who were so tenderly united by love, and intellectually so great and intimate, must have been a sublime spectacle. Wilhelm, above all others, could comprehend and appreciate the new views of his brother concerning the great phenomena of nature in the New World; and he, himself, in consequence of Alexander's discoveries, could realize a more

*The brothers Humboldt were called "German Dioscuri."

universal stand-point in his special department of classics and politics.

A new phenomenon of nature, and in the immediate vicinity of Rome, called Alexander von Humboldt, in the summer of 1805, away from the city. Vesuvius gave indication of greater activity, and an eruption appeared imminent. Humboldt, accompanied by two friends, Leopold von Buch and Gay-Lussac, who had come purposely to Italy in order to witness this phenomenon, arrived on the 12th of August, during a remarkable eruption. The experience which Baron Humboldt had already obtained with regard to the volcanic phenomena of the earth, and the presence and assistance of celebrated men of science, made these observations more especially valuable. He added new experience to his former observations of the magnetic needle, already commenced during his residence at Paris in 1798. He examined more especially the magnetic properties of certain kinds of rock.

Alexander von Humboldt left Italy for Berlin, where he remained during the years 1806 and 1807, and had to witness the sad political degradation of his country, but where he nevertheless achieved new scientific conquests. He continued his observations of the mag-

netic needle; and his numerous investigations during his travels, at this time, and subsequently, on one and the same magnetic needle, not only animated other able naturalists to institute similar observations, but furnished the material afterwards used by Biot in the calculation of the magnetic equator.

Humboldt had, together with Gay-Lussac, with whom he entered into a most intimate elation, continued these observations, and discovered that neither the great mountain-chains, nor yet the active volcanoes, exercise a perceptible influence on the magnetic force, but that it gradually changes with the distance from the equator.

It is supposed that Baron Humboldt prepared one of his few works in the German language in Berlin, because in the following year (1808) appeared his "*Ansichten der Natur*," dedicated to his brother Wilhelm. The powerful impression produced on Wilhelm von Humboldt by a perusal of this work is strikingly reflected in a poem, in recognition of this dedication, which Alexander concealed from the eyes of the world until the death of Wilhelm. In this poem Wilhelm placed himself amid the same wild and sublime nature, in the midst of the undeveloped higher existence, and realized also the conscious-

ness and the hopes of the new world unfolded to his view. He compared the poverty and the grandeur of the new with the old world; he placed the Pelasgians and Greeks *vis-à-vis* to the Indians; and discovered in the contrast mighty laws of historical life.

After Baron Humboldt's return to Paris, he pursued more exclusively his literary labours, and the supervision of the gradual publication of the great work concerning his American travels. These results of varied and important investigations embraced many branches of science. His studies and observations afforded rich material for further researches and comparisons; and it became absolutely necessary for Baron Humboldt to unite with other scientific men, in order that special attention might be paid to the several departments of science. The most distinguished men of the day considered it an honour to co-operate with Humboldt in this gigantic work. The whole is written in the French language, and divided in different series of publications, relating to the special departments of science. In the regulation of the collected astronomical observations and barometrical measurement of heights Oltmann laboured successfully under the guidance and with the assistance of Humboldt;

in the chemical and the meteorological departments, Arago and Gay-Lussac assisted; the zoological part of the work was enriched by valuable contributions from Cuvier and Latreille; in the mineralogical department, Vauquelin and Klaproth afforded valuable assistance; in botany, Professor Kunth of Berlin lent his aid.

This great work is entitled, "Voyage aux régions équinoxiales du Nouveau Continent, par A. de Humboldt et A. Bonpland," of which a folio and an octavo edition appeared; besides an "Atlas géographique et physique," and a collection of picturesque drawings. Four volumes contain more especially a description of his American travels: "Rédaction historique." The comprehensive nature of this colossal work may be superficially estimated, considering that, in spite of its commencement forty years ago, and the assistance of a number of able and competent men of science, its completion reaches our own time.

A survey of the whole work, irrespective of the time in which the various parts appeared, but rather in harmony with the order of the date of the discovery of the original material, furnishes us with the "Vue des Cordillères et Monuments des Peuples indigènes de l'Amé-

rique," in two volumes, containing sixty engravings, black and illuminated; a striking picture of the luxuriant vegetation of the tropics; the formation of the mountain-chains of the Andes, and an interesting account of the origin, manner of life, travels, languages, &c. of the natives; likewise important observations with reference to the ancient architecture and monuments of the primitive inhabitants of Mexico and Peru. Two volumes, "*Essai politique sur le Royaume de la Nouvelle Espagne*," with an atlas, and the "*Essai politique sur l'Isle de Cuba*," furnish a valuable picture of the political condition of Mexico and Cuba, and afford still, in spite of the great changes in those parts, excellent information regarding them.

The observations of Baron Humboldt with reference to the various kinds of animals—zoology, are contained in two volumes, "*Recueil d'Observations de Zoologie et d'Anatomie comparées, faites dans un voyage aux Tropiques*," in which section, as already intimated, Cuvier and Latreille offered valuable assistance. The science of botany comprised a series of works, and was the most important field of Bonpland's labours. This faithful friend and fellow-labourer of Humboldt had, during their travels, collected

above 6,000 kinds of new plants, observations upon which enabled Humboldt to open new avenues with regard to the laws of plants and their relation to the earth. The great work, "Essai sur la Géographie des Plantes," and a still more elaborate account in the "Prolegomena de Distributione Geographica Plantarum secundum coeli temperiem et altitudinem montium," establish in a striking manner, enriched by manifold experience, the importance of geography with regard to botany, and the immediate relation of the geography of plants to their history and the science of climate.* It shows, furthermore, how the number, the relation, and the local distribution of plants must of necessity vary in accordance with general laws in the different zones, from the pole to the equator; from the depth of mines and the bottom of the sea, to the summit of mountains covered perpetually with snow; relatively to the geographical position of the locality, and the condition of the environs. The special history of the new discoveries in botany Humboldt was obliged to leave to his fellow-labourers.

* See the profound essay of Mr. William Hopkins, of Cambridge, "On the Causes of Changes of Climate at Different Geological Periods," *Quart. Journ. Geol. Soc. Lon.*, vol. viii. p. 56.

Thus Bonpland alone published two works, viz., “*Plantes équinoxiales au Mexique, dans l’Isle de Cuba, dans les Provinces de Caracas, Cumana,*” &c., a methodical description of plants in the French and Latin languages, with notices regarding their medical qualities and industrial applications. The other work is called “*Mono-graphie des Rhexia et des Melasthomas,*” families of plants almost exclusively confined to South America, and, for the most part, trees and shrubs.

In the departments of geology and astronomy, Humboldt contributed a series of works. With the assistance of Oltmann, two volumes appeared: “*Observations Astronomiques,*” which contained the results of Humboldt’s observations between 12° S. and 41° N. lat., with regard to the passage of the suns and the stars through the meridian; with reference to eclipses, the refraction of the rays of light in the torrid zone, and likewise barometrical mensuration of the Andes of Mexico, Venezuela, Quito, and New Granada.

Humboldt furnished an interesting history of the geological formations of the earth in the Old and the New World, in his “*Essai sur le Gisement des Roches dans les deux hémisphères.*” The price of a single copy of the

folio edition of this comprehensive work of Baron Humboldt's travels, closely connected in its separate divisions, was, even in 1844, when many parts which we now possess had not yet appeared, about £391 (2,700 Thaler), twice as much as the well-known national work of France, "*Description de l'Egypte*," and for whose completion the French Government had to advance about £115,000 (800,000 Thaler).

The enormous expenses of the whole edition become evident from the price of a single copy, and more so when we learn that the cost of printing, paper, and engraving, for this gigantic work, amounted to more than 226,000 Thaler (about £32,487. 10s.). Yet this great literary undertaking has been successfully accomplished by the assistance of the intelligent public in all parts of the civilized world, and the great pecuniary sacrifices of Humboldt himself.

From the year 1808, Alexander von Humboldt lived almost exclusively in Paris. In 1811 he visited Vienna to take leave of his family (his brother Wilhelm being at that time the Prussian Ambassador to the court of Austria), before setting out on his projected journey to Central Asia and Tibet. The Russian Government had made an offer to Baron Hum-

boldt to accompany an expedition by way of Kaschghor to Tibet, which was at once accepted. He was anxious to visit the noted mountains of India, in order to ascertain their geological relation to the mountains of the New World. Unfortunately the outbreak of the war between France and Russia, in 1812, frustrated this project, and Humboldt returned by way of Vienna to Paris, still determined to execute this journey on some future day. For this purpose he studied for some years the Persian language, and decided to proceed by way of Teheran or Herat to India. He acquired a theoretical knowledge of the structure of the mountain-chains of Asia, and could give a satisfactory opinion with reference to the achievements of naturalists who had already visited the Himalayas. A variety of circumstances made this projected journey especially attractive to Baron Humboldt. The tableland of Central Asia, where tradition places the cradle of mankind, the mountains of India, the remarkable conditions of the limits of perpetual snow—inspired Baron Humboldt with a peculiar love for the study of Asia. Although the French Government and the King of Prussia had, in the interest of science, offered assistance in furtherance of Humboldt's intended explora-

tion of Asia; circumstances which we cannot here discuss, caused the abandonment of this plan.

Towards the close of the year 1818, Humboldt left Paris. In that year he experienced the painful separation from his friend Bonpland—a separation for ever in this world. The fate of this eminent naturalist—the faithful companion and participator in Humboldt's perilous exploration of America—awakens a lively sympathy. It appears that soon after his return, with Humboldt, from America, his amiable disposition made him a general favourite in Paris. The Empress Josephine being passionately fond of flowers, Napoleon appointed Bonpland—with whom he had become acquainted—Director of the Gardens of Malmaison, which contained already a splendid collection of exotic plants. After the downfall of the Empire, he left France, and proceeded, as Professor of Natural Philosophy, to Buenos Ayres.

For a long time nothing was heard of Bonpland, until at last the news of his sad misfortune reached Europe, and came thus to the knowledge of his friend Humboldt. Bonpland had originated an Indian colony in the interior of Paraguay—at St. Anna, on the eastern shores of the river Parana; and visiting this

place in the year 1820, he had scarcely arrived, when soldiers surrounded him, and took him a prisoner to St. Martha, after they had first destroyed the plantations. This violent act was due to the revenge and the selfishness of the Dictator of Paraguay, Dr. Francia. This personage had long watched with a jealous eye the tea plantations established by Bonpland on several points of Brazil ; tea being the principal article of export of that country. Bonpland was detained at St. Martha, where, however, he was permitted to be at large and practise as a physician.

Humboldt immediately interceded on his behalf, and made representations to all his influential friends ; but unfortunately his intercession produced no favourable result at Paraguay. It was not until the year 1829 that Bonpland regained his liberty, and returned to Buenos Ayres.

In the month of September, 1818, Alexander von Humboldt arrived in London, where he met his brother Wilhelm, who at that time occupied the post of Prussian Ambassador there, and who had taken considerable interest in the suppression of piracy, and the extinction of the slave-trade. Alexander appeared also in an official capacity. The Allied Powers had instructed

him to prepare a political survey of the colonies of South America. In the month of October, the King of Prussia called him to Aix-la-Chapelle, where he remained until the 26th November. From thence he returned to Paris, where he lived for a series of years exclusively engaged in his studies.

No European city afforded Baron Humboldt greater facility in furtherance of his objects; there he enjoyed immediate intercourse with his celebrated friends and fellow-labourers, Arago, Gay-Lussac, Julian, Cuvier, Valenciennes, and others; Paris being, moreover, at that time, a great intellectual centre.

In the autumn of 1822, the King of Prussia, on his road to the congress of Verona, met with Alexander von Humboldt, and invited him to accompany him on a tour through Italy, especially to Venice, Rome, and Naples. During that period — from November 22nd to December 1st—Humboldt ascended Vesuvius three times, in order to repeat his former observations, conducted in August, 1805, in company of Leopold von Buch and Gay-Lussac, and also in order to examine the condition of the borders of the crater after the recent eruption.

At the beginning of the year 1823 he arrived with the King of Prussia in Berlin, where he

enjoyed for a brief period the society of the most noted men of the capital, and returned soon again to Paris, in order to accelerate the publication of his great work. It had long been the wish of Wilhelm von Humboldt to see his brother Alexander permanently established in Berlin. Now he received a formal invitation from the King of Prussia, who was anxious to secure his society and scientific counsel. It is, however, certain that it was not the favour of this accomplished prince that determined Baron Humboldt's choice. It was his brother Wilhelm, for whose society he yearned, with whom he was united by more than one tie, and from whom he had been so long and constantly separated. After the necessary arrangements in Paris, he arrived in Berlin, and his brother Wilhelm said already, in a letter addressed to Gentz,* May 21st, 1827, "Alexander is now permanently established here; he is very active and cheerful, and we often speak about you." Henceforth he lived in the immediate society of the King, whom he accompanied on his varied journeys, and only for

* The celebrated "Schriftsteller-Staatsmann," — this writer-statesman—justly and happily so termed by Varnhagen von Ense.—(See *Edinburgh Review*, January, 1863, p. 44.)

a short time he paid an annual visit to the French capital, which had become to him, in consequence of numerous associations and long residence, a second home. In Berlin, Baron Humboldt met many of his former friends, and especially, on his arrival, the celebrated Baron von Stein, and in May, A. W. von Schlegel, who, after an absence of twenty years, arrived again in Berlin, he having been appointed, through the influence of Wilhelm von Humboldt, in the year 1818, a Professor of the University of Bonn. The presence of Schlegel was more especially marked by his public lectures "on the History of Art and Science," patronized by a numerous and intelligent portion of the public. The society of these eminent men exercised necessarily an animating influence upon Alexander von Humboldt, and on July 3rd, he delivered, before the Academy of Sciences, a lecture on his favourite subject, "The Causes of the Difference in the Temperature of the Earth."

Here he commenced also, on November 3rd, 1827, the sixty-one lectures, already mentioned in the earlier part of this essay, on Physical Cosmography—a sketch of his celebrated "Cosmos," the results of his long observations and researches in all the various depart-

ments of science. The anxiety manifested by all classes of society to hear these lectures, induced Baron Humboldt to commence a second course at the same time, intended for a more mixed audience, in the music-hall of Berlin.

His brother Wilhelm remarked, in a letter addressed to a friend in Vienna, who regarded every extraordinary phenomenon as something of a demoniacal nature: "Alexander is indeed a 'puissance,' and has gained, in consequence of these lectures, a new kind of renown. They are unsurpassable! It is now, as it always has been, a characteristic of his to exhibit a peculiar timidity, an undeniable diffidence, in the manner of his public appearance."

Alexander von Humboldt yielded to a general wish, expressed in all parts of Germany, and supported by the press, to consent to the publication of these lectures, in order to enable the intelligent public to become acquainted with them, and he resolved accordingly to have them published, under the comprehensive title—"Cosmos."—A variety of circumstances delayed the publication for several years.

We have already noticed that Baron Humboldt postponed his contemplated journey to Asia, in 1812, on account of the war of France and Russia. In 1827, during the time Hum-

boldt delivered his public lectures in Berlin, the Emperor Nicholas of Russia made him the munificent offer to undertake an extensive journey through the Russian Empire, at the sole expense of the crown, and with the express wish to regard the possible advantages which might accrue to mining and industry, in consequence of his researches, as an entirely immaterial object of this journey, the advancement of science being of paramount importance.

Humboldt accepted this generous offer, though he could not immediately set out on his journey. During his preparation, in 1828, the Society of Naturalists—originated by Oken—held their seventh annual meeting in Berlin, and elected Alexander von Humboldt and Lichtenstein the presidents. The practical mind of Humboldt found here new scope. It appears that this annual meeting did not adequately fulfil its object, because the various branches of science were not distinctly divided, and the enormous accumulation of material could not be thoroughly surveyed, much less properly estimated, considering the limited time of their assembly. Humboldt at once recognised this defect, and proposed a division into different sections, which would enable the members to communicate their more special experience in

separate departments, and to indicate any further progress ; whilst the collected material belonging to science in general, might be reserved for united consideration.

Humboldt opened this scientific meeting with a most important speech concerning the object and the value of these annual gatherings ; and his opinion, as usual, exercised a powerful and animating influence upon the whole civilized world. A few years afterwards both England and Italy originated similar associations and meetings, whose influence and importance is every day more widely recognised.

The career of Alexander von Humboldt, though on the whole very prosperous, was nevertheless, as has been already shown, intermixed with disappointment, care, and anxiety. To this was added, in the year 1829, a sad bereavement. Madame von Humboldt, the wife of his brother Wilhelm, had been for some years in a feeble condition of health. She had received temporary relief from the waters of Gastein, to which she again resorted in the summer of 1828. She returned with her husband in the middle of September to Tegel, and soon afterwards the chronic disease assumed such an alarming aspect, that, towards the close of November, she was in a state of gradual

dissolution. The feelings of Alexander on this occasion may be estimated by the profound sentiments which he exhibited in his private life, and in the description of his memorable travels. The sight of his beloved brother, who mourned hopelessly at the deathbed of a most tender wife, he himself watching the gradual approach of the threatened hour of final dissolution of his dear sister-in-law, so highly accomplished, and of such noble and gentle a disposition—what a pain and anguish to his own soul! The final dissolution of Madame von Humboldt was, however, prolonged far beyond expectation, and she lingered to the new year, 1829. On Sunday, January 22nd, after a visit to Tegel, Alexander von Humboldt gave a description of the dying Madame von Humboldt to his friend Rahel; * and his few words testify his profound grief: “She was dying,” he said; “she opened her eyes and said to her husband, ‘I am ready!’ She herself welcomed death. But in vain. Again she rallied and participated in the passing scenes. She prayed much.” This state continued until March 26th, 1829. On that day the news arrived in Berlin that death had at last relieved Madame von Humboldt from her long sufferings.

* The wife of Varnhagen von Ense.

Her early departure caused considerable grief and mourning. Her various travels had brought her in an intimate relationship with the chief celebrities in science and art, and her house in Rome, Vienna, Paris, and Berlin was always the centre of a most refined and intellectual society.

Alexander von Humboldt remained with his brother Wilhelm until April 12th, 1829, when he left Berlin on his journey to Central Asia. He had endeavoured by all possible means to soothe the grief of his brother, and in anticipation of the probable results, which the absolute loneliness of Wilhelm at Tegel, mourning over the grave of his Caroline, might cause; considering the peculiar trait of sentimentality and of enthusiasm which distinguished Wilhelm von Humboldt,—Alexander interceded on behalf of his brother with the King, intimating that active service would be the best antidote to his overwhelming grief. Certain it is that soon after Alexander's departure the King called Wilhelm von Humboldt to Berlin, in order to preside over a commission charged with the internal arrangements of the new museum—a post for which he was pre-eminently qualified. On April 12th, Alexander von Humboldt took leave of his brother, and proceeded on his

second journey,—the exploration of the interior of the great Russian empire, to the Ural, the Altai, and the Caspian Sea.

We had occasion, in the earlier part of this sketch, while giving a glimpse of Humboldt's position as a man of science in the world of knowledge, to refer to this journey. Baron Humboldt was accompanied by Gustav Rose and Ehrenberg, and in order to afford every facility to the renowned traveller, the Russian minister, Count Cancrin, noted as a friend and protector of science, caused every arrangement to be made which could insure the comfort and the security of the travellers. A mining officer, Menschenin, was ordered to be the constant attendant of Baron Humboldt, in order to give the necessary information regarding the route and the localities, and to demand, in case of need, the assistance of the authorities. Enjoying, by this means, all the comforts of imperial hospitality, the travellers left Petersburg May 20th, and proceeded by way of Moscow on their journey. Near Nischnei-Novgorod, they embarked, and arrived, after a short voyage on the Volga, June 4th, at Kasan. They examined the Tartar ruins near Bulgari, the ancient capital of the Mongols, and continued their journey by

way of Perm to Ekatharinburg, on the Asiatic slope of the Ural mountains. There Humboldt remained four weeks, during which time he made a series of important investigations on the middle and northern part of the mountain-chain, which afforded most interesting material with regard to their position and formation, and their metallic contents. "Their highest peaks (according to Sir Roderick Murchison—*Siluria*, chap. xix. p. 480) rarely rise above 5,000 to 6,000 feet." The manner of their expansion, and their position in the meridian, reminded Humboldt of the analogous position of the Andes of America. The central and northern parts of the Ural mountains are auriferous, more especially where the alluvial formations predominate. This circumstance led Humboldt to interesting investigations, and, in spite of his short sojourn of only four weeks, he attained splendid results with reference to the composition and the formation of the alluvial strata, which contain gold * and platinum, the existence of new metals, and the condition of the different formation of rocks.

It would no doubt be a matter of surprise how

* "No country furnishes a clearer example than Russia, of the dependence of gold on certain geological and mineral relations."—*Siluria*, third edition, chap. xix. p. 479.

all this could have been accomplished in such a limited time, if we were not already acquainted with the great diligence, and the remarkable powers of observation possessed by Baron Humboldt.

It is possible that the peculiarities of this mountain-chain induced Sir Roderick Murchison to examine the Ural in the year 1842. The results of his elaborate investigations are contained in his *Siluria*, chap. xix.; and at pages 479-80, occurs the following important passage:—"The study of this Uralian chain enabled me to suggest, in the year 1844, by comparison of the rocks of the two countries, that Australia would also prove to be an auriferous region. The survey of the Ural mountains in 1842 led me further to define, within certain limits, the period when the Silurian rocks were chiefly impregnated with gold, and also to affirm that gold, as a distinct metallic mass, is of younger date in that region than the associated ores of copper and iron."

Humboldt visited the noted magnetic mountain Blagodad, and the celebrated topaz-bed of Murzinsk, near Nischnei-Tigitsk, which reminded him of Choco, in South America; Humboldt found a piece of solid platinum,

weighing more than eight kilogrammes. After he had determined the astronomical position of several localities, made magnetic observations, and ascertained various heights, he continued his journey from Ekatharinburg by way of Ijumen to Tobolsk, on the Irtisch ; and further by way of Tara, through the horrible Borabinskian desert. This wilderness, noted on account of its numerous insects belonging to the family of the Tipulæ—a region notorious throughout the land, and especially dreaded by those who dwell near it,—Humboldt traversed with the same self-sacrifice and perseverance in the service of science, which we already admired in his heroic exploration of the Orinoco.

On August 2nd, Humboldt reached Barnaul, on the shores of the Obi ; from thence he visited the picturesque sea of Kolywan, and the rich silver-mines of Riddersk and Zyrianowskoi, on the south-western slope of the Altai, whose highest peak Bjelmha is equal in height with Etna.

From Riddersk he took a southern direction, towards the small fortress of Ust-Kamenoigorsk ; and arrived by way of Buchtorminsk on the frontiers of the Chinese Dsungarey. Here he obtained permission to pass the frontiers, which enabled him to visit the Mongol station of Bati,

and arrived, August 17th, in about the centre of Asia, north of the Dsaisang sea.

On his return to the fortress of Ust-Kamenoigorsk, Humboldt observed on the lonely shores of the river Irtisch, in an expanse of more than 16,000 feet, enormous masses of granite in an horizontal position, underlaid by clay-slates, parts of whose strata appeared in perpendicular position, and partly at an angle of 85 degrees. This phenomenon became of great importance to Humboldt, with reference to the formations of granite.

From the fortress above named the travellers journeyed through the steppes of Ischim towards the South Ural; visited Semipalatinsk, Orusk, &c., and arrived at Mjask. From this place Humboldt undertook several excursions in the environs; and discovered in this district, on a small space, and only a few inches below the surface, three pieces of solid gold. Continuing his journey southward, he arrived at Orsk, where he examined the noted strata of green jasper, and collected other valuable material for geological investigations on the river Jaik, which broke through the mountain-chain in a north-western direction.

Humboldt pursued his journey to Orenburg, where he arrived by way of Guberlinsk, on

September 21st. At this place, where caravans of some thousands of camels annually arrive, Humboldt became acquainted with a M. de Gens, a well-informed man, much interested in the geography of Asia, relative to which he had collected a considerable amount of valuable material.

This gentleman afforded important information to the naturalists, the results of his own travels. He acquainted Humboldt with the existence of a high mountain, once a volcano, which, in consequence of violent storms supposed to be occasioned by it, still alarmed the passing caravans. Passengers are in the habit of sacrificing sheep to this mountain, which is situated in a north-eastern direction from the great Balcasch lake, which receives the waters of the river Ili. This information Gens had obtained from a Tartar; and Humboldt immediately remembered the volcanoes, described in Chinese books as situated at a considerable distance from the sea, and which had aroused the curiosity of geologists in consequence of the representations of Klaproth and Amusat. Humboldt, furnished with additional information by the Russian director of police at Semipalatinsk, further investigated this subject with special care; and in order to establish the

organic connection of this noted volcano with other phenomena and the condition of the soil, Humboldt published, soon after his return from this expedition, a most interesting account of the geography of this zone, still but imperfectly known. He next examined the noted salt-mine of Ilezk, the principal place of the Uralian Cossacks; visited the German colonies on the Volga, in the department of Saratow, the great salt lake Elton, the beautiful settlement at Sarepta, and arrived in the middle of October at Astracan on the Caspian Sea.

The more immediate object of this journey to the Caspian Sea was the minute chemical analysis of its waters—being the most important lake known; a task specially undertaken by Gustav Rose. Humboldt instituted likewise barometrical observations, in comparison with his measurements of Orenburg, Sarepta, and Kasan; and hoped lastly for some zoological acquisitions, intending to collect fishes in the Caspian Sea, in order to complete, by the addition of new specimens, the great work of Cuvier and Valenciennes, on fishes. For this purpose Humboldt and his companions undertook a short fishing voyage on the lake.

Having accomplished the desired investigations, the travellers returned from Astracan, by

way of the isthmus which divides the two rivers Don and Volga, in the vicinity of Tischinskaya; through the country of the Don Cossacks, through Woronesh and Tula, and arrived again at Petersburg November 13th. Here Humboldt only remained as long as his obligations towards the Court and Government required, and until his collections had arrived. On December 28th, 1829, he reached the city of Berlin in perfect health and safety.

Baron Humboldt had been absent from Berlin from April 12th, until December 28th; and rarely has been, in so short a time, a more extensive territory investigated; for, in little more than eight months, a journey of 2,500 miles had been accomplished; considered in a direct line, nearly one-half of the whole circumference of the earth.

The important results of this journey, already noticed in the earlier part of this sketch, will be found in the "*Reise nach dem Ural, &c.*" by Humboldt, Ehrenberg, and Rose.*

* In retrospect of his first visit to Russia in the year 1840—eleven years after Baron Humboldt—Sir Roderick Murchison, the President of the Royal Geographical Society, in his address at the Anniversary Meeting, May 22, 1865, said:—"When we look back to the condition of the geography of Russia in the year 1840, when I first visited

Although Alexander von Humboldt had selected Berlin as his permanent residence, the publication of his new works required a prolonged residence in Paris, in order to obtain the personal co-operation of his scientific friends. Thus he lived alternately in both cities. The French Revolution of 1830 caused a sudden

that country, and consider its present advanced state, we may truly say that the strides made in the quarter of a century which has elapsed are most surprising. At that time there was not even a reliable map of Russia in Europe ; no railroad had been commenced, and now such lines of communication are in the course of extension over wide tracts of European Russia. Nay, more, the electric telegraph is about to be carried on the one hand across Eastern Siberia and Mongolia to Peking, and on the other from the mouth of the great river Amur northwards, to the shore of the Sea of Okutsk, passing by Kamschatka to Behring's Straits ; across which there will be no difficulty in establishing a submarine cable. Thence traversing Russian North America and running along the shores of British Columbia, this gigantic line will terminate in California and the United States." The numerous important changes which have been made in the position of places and the contour of the vast countries of Eastern Siberia, and all that portion of Asiatic Russia which borders Mongolia and China, will soon appear in a general map, the numerous and laborious researches on which it is founded, being mentioned in the *Compte Rendu* of the Imperial Geographical Society. Other highly important works in the great province of the Caucasus, and the results of the surveys around and soundings in the Caspian Sea, are also enumerated.

agitation in Europe; political changes were imperatively demanded; and Germany in general, and Prussia in particular, were placed in critical positions. Though Alexander von Humboldt had never taken any active part in political matters, the peculiar nature of the difficulties to be encountered, the absolute confidence of the King of Prussia in Humboldt's integrity, and the fact that in his scientific sphere he belonged to two nations—for the French considered him a great contributor to their national literature, and an honour to their country; whilst Germany claimed him as her natural son—all these circumstances singled him out as pre-eminently qualified to act as a mediator between two nations who were equally proud of his renown.

For this purpose, Alexander von Humboldt undertook, at the request of the King of Prussia, a diplomatic mission to Paris, in order to congratulate Louis-Philippe and the new dynasty on their accession to power. His brother, Wilhelm, had likewise been called from private life, and had been appointed a Councillor of State. Thenceforth, the two brothers lived almost exclusively together. While the elder brother contemplated the laws of the intellectual and historical life, or examined

the traces of departed nations and their languages, and had his researches not unfrequently concentrated on one single point, the younger brother surveyed the physical aspect of the globe. Both found their point of union again in the study of the various races of men, their intellectual capacities, and the variety of their languages.

Alexander von Humboldt must about this time have paid a visit to Göthe, at Weimar, because in a letter addressed by the poet to Wilhelm von Humboldt, December 1st, 1831, we find the following passage:—"I am much indebted to your brother, for whom I cannot find a surname, for a few hours of unrestrained conversation; and although his geological views, and manner of investigation, make my cerebral systems altogether impossible, I have observed, with sincere regard and admiration, how facts of which I cannot convince myself, appear to him perfectly clear, and in absolute continuity with his comprehensive acquaintance of nature, preserved intact by the rare symmetry of his amiable character."

Already in the year 1830 Wilhelm von Humboldt regarded the vigorous health of his brother a fortunate phenomenon, and cherished the hope that he, if the survivor, would watch over

his literary remains ; for he could not conceive better hands to which this legacy could be entrusted. Alas ! this expectation was soon realized. Only for a short time were these remarkable brothers permitted to live more closely together ; during which time Alexander entered in an intimate relation with the friends of his brother Wilhelm : with Göthe, Wolf, Frau von Varnhagen, Korff, Cotta, Gentz, &c. Many of the friends of Wilhelm von Humboldt had been already called away ; amongst them, Niebuhr and Stein in the year 1831 ; Göthe and Gentz in 1832 ; Hegel and Schleiermacher. In the winter of 1834-35, Wilhelm von Humboldt was seized by weakness, during his residence at the Castle Tegel, attended by his eldest daughter, Caroline. Alexander, who resided in Berlin, watched with anxiety the state of his brother's health. His physical prostration and bended gait awakened his apprehension. A cold which seized him, in addition to his other ailments, on visiting the tomb of his deceased wife on the return of her birthday, accelerated his demise. On April 8th, 1835, he expired in the arms of his brother Alexander. During the last death-struggles of his beloved brother, Alexander addressed a letter to Varnhagen, which expressed his profound grief at the

early departure of Wilhelm ; and in a subsequent letter to Arago, April 10th, he relates the sad loss of his brother in these words :—" Je suis dans le plus profond abattement. Dans les plus grandes douleurs on pense à ceux qui nous sont les plus chers ; je me sens un peu soulagé en vous écrivant. . . . Je reste bien isolé."

Alexander von Humboldt honoured the memory of his departed brother, above all, by the regular publication of his literary works.

Soon after this sad event, Humboldt was again exclusively engaged in his scientific investigations ; and contributed continually to the general acquisitions of science. The publication of the results of his expedition to Central Asia demanded still his principal attention : a variety of other scientific works already commenced, and especially his "Critical Examinations with reference to the Historical Development of the Geography of the New World, and the Progress of Nautical Astronomy in the 15th and 16th Century." In four regular divisions, Humboldt treated of,—1. "the Causes which originated and accomplished the discovery of the New World ; 2. some facts more especially connected with Christopher Columbus and Amerigo Vespucci, and various dates of geographical discoveries ;

3. the first Maps of the New World, and the epoch when the name "America" was universally applied; 4. the Progress of Nautical Astronomy and Geography in the 15th and 16th century." In the year 1838 Humboldt published, in Cotta's *Quarterly Review*, "A Politico-Economical Treatise with reference to the vacillating Condition of the Production of Gold, based on his Investigation of the Ural Mountains;" and during the years 1839-40 he published "A New Hypsometric Map of the Mountain-chains and the Volcanoes of Central Asia."

In the midst of these important labours, the death of Friedrich Wilhelm III., king of Prussia, an event which concerned Humboldt more immediately, occasioned a temporary interruption in the progress of his works, though his position remained, after the accession of Friedrich Wilhelm IV., entirely unchanged. The new king had long enjoyed the acquaintance of Humboldt; his love for art and science, and his desire for refined society, drew him naturally towards the great philosopher, notwithstanding their heterogeneous views concerning political and religious matters. Baron Humboldt became the confidential friend of the new king; his companion and scientific counsellor. He lived henceforth in the immediate vicinity of the king, whom he

generally accompanied on his various journeys. In 1840, Humboldt was engaged on a treatise regarding his ascent of the Chimborazo, and the mean height of the continent; a critical *mémoire* respecting some important points of Guiana; the gradual completion of his "Cosmos;" with the additional achievements of science since its first commencement; likewise with the publication of the posthumous MSS. of his brother Wilhelm; and assisted, lastly, as a member of the royal commission charged with the publication of the works of Frederick the Great. From these various and important labours, the king called Humboldt in January 1842, in order to accompany him to England, to the baptism of the Prince of Wales. Though he enjoyed this special mark of the king's favour, and met with a respectful reception from the Court of England, his personality gave to this royal visit a special significance. The intelligence of England paid, on every public appearance of Baron Humboldt, a well-deserved homage to the great savant. In Berlin, Potsdam, and the other royal residences, apartments were reserved for him, and he was in daily intercourse with the king. Notwithstanding his years, his industry was remarkable; he observed a great punctuality in his immense correspond-

ence, and answered with modesty every letter. Nearly all the inhabitants of Berlin and Potsdam knew him, and received him with the same marks of respect as the king. He might be frequently seen in the streets and public walks of these cities, walking with a firm and measured step, though somewhat stooping gait; nearly always alone, and apparently engaged in deep thoughts. His garments were plain and unpretending, in harmony with his whole manner of life. Wherever he appeared, he received universal proofs of respect. Groups of the lower order were frequently observed to watch him in his walks, with every sign of veneration.

Those who had the good fortune ever to converse with the illustrious philosopher will scarcely forget the impression which his natural manner of conversation inevitably produced. Every utterance of Baron Humboldt evinced his profundity in all branches of knowledge, and the perspicuity of his representations. He had been educated in the great world; in him were concentrated the noblest manners of Europe!

In his advanced age he still sought the schools of the young, in order, as he declared, to repair, if possible, earlier neglect. Thus, during the winter term of 1834-35, he appeared

at nine o'clock in the morning at the University, in order to hear the lectures of Professor Boekh on Greek literature and antiquity. Here Humboldt took his seat on the fourth or fifth form, below the window, produced from a small map a piece of paper, and noted the leading features of these lectures. He likewise attended the lectures of Carl Ritter on general science; and not unfrequently it happened that the lecturer quoted him as an authority on geognostic questions. On these occasions the students turned involuntarily towards the venerable hearer, whose presence gave a powerful incentive to their studies.

A survey of the life of this distinguished man, specially chosen to be an interpreter of nature and her laws, and the results of his intellectual activity, we endeavoured to furnish, in general outlines, at the commencement of this essay. We will once more consider the main results of his life-long investigations. Alexander von Humboldt was in so many branches of science the first who introduced perspicuity and intelligibility, that it is, indeed, difficult to know where to commence. It is due in general to state of Humboldt, that he was the first who regulated and classified isolated scientific facts of the past and the present, and who assigned

to everything its proper place, in order to establish the necessary harmony of the whole. His critical insight assigned to the apparent lawless a fixed law; the isolated found its kindred groups. He thus revealed and laid open the united life and activity of our planet in its actual being. He became, as testified by his life, the founder of a comparative cosmography, the originator of the science of geognosy, and indicated, with his friend Leopold von Buch, the volcanic activity which influences the formation of our earth. He was the founder of the geography of plants, an entirely new science, regarding the laws of their distribution. He discovered a new world, with new forms, new life, manners, languages, and the remains of an unknown antiquity. He likewise was the reformer of geographical maps; and, lastly, the originator and the representative of a new method in the investigation of general science, which is daily becoming more developed. He endeavoured to realize a more universal standpoint, tracing continually the mutual connection of the divers branches of science, watching nature in her secret laboratory, searching for new facts, and discarding all kinds of speculations. The internal complication of cause and effect, isolated, and in its relation to the whole,

afforded him a guide to the discovery of its laws. He originated the modern school which unites physical science with human history, and which has produced, in its mode of investigation, remarkable results. This mathematical, exact method of research is due to Humboldt. It is at present the acknowledged method of the most eminent naturalists, though it cannot be denied that it led to the most trifling empiricism in those who only adopted Humboldt's method, without possessing his powers of combination, and his lofty insight into the laws of the physical Cosmos.

When we consider the style in which Humboldt's works are written, we find repeated confirmation of the well-known motto: "The man himself is the style."

Two nations, the Germans and the French, claim Humboldt as a classical author. In both languages he is equally eminent in the striking simplicity of his literary productions, although he had frequently to deal with subjects in themselves dry, and notwithstanding that the repetition of strict scientific facts is ill adapted for elegant forms. His scientific dissertations are distinguished by certainty and consecutive evidence. His descriptions of nature are faithful pictures, which produce an immediate and vivid

impression. The exact manner of Humboldt's conception of nature enabled him to portray the great features of her phenomena in a most attractive manner.* He possessed the rare capacity of avoiding all rhetorical embellishments. His views concerning the great waters of our earth; his descriptions of the prairies of Central America, the immense forests, the desert, and the ravines of the mountain-chains of Mexico and Peru; the lofty peaks covered perpetually with snow, and void of all traces of vegetable life; the craters of numerous volcanoes; are the faithful reflex of nature. Humboldt, in describing any isolated object, a phenomenon, or a discovery, never indulges in poetical exclamations or possible exaggerations, but brings us face to face with reality. He not only sustains but increases our interest in the great pictures of the united life and activity of our earth. To

* "When genius arrives, its speech is like a river, it has no straining to describe, more than there is straining in nature to exist. When thought is best, there is most of it. Genius sheds wisdom like perfume, and advertises us that it flows out of a deeper source than the foregoing silence, that it knows so deeply and speaks so musically because it is itself a mutation of the thing it describes. It is sun and moon and wave and fire in music, as astronomy is thought and harmony in masses of matter."—(*R. W. Emerson's Oration, "The Method of Nature."*)

him the whole is an open book; he surveys nature in her entirety. In his considerations of the great and the small, of majestic and awful phenomena, the description of a mineral, a plant, or a law relative to formation and development, we have a uniform and correct representation of nature. These impressions are free both from morbid sentimentality and subjective peculiarity.

In the illustration of his American travels, Alexander von Humboldt instituted a method which, if not new, was, in this instance at any rate, signally successful. He adopted in his progressive descriptions, frequent points of rest, designed to enable his readers to review the preceding facts, and to prepare them for the progressive development of events.

Ordinary accounts of travels absorb a great part in relating the personal adventures and achievements of the chief actor. They are not unfrequently one-sided, subjective, and monotonous, which is nearly akin to the tedious.

Alexander von Humboldt never desired to bring his own personality prominently forward; he, on the contrary, evinced a continual anxiety to affix to the scientific achievements, which were the more immediate results of his own

investigations, the seal of the purely scientific. And it is noticeable in the history of this great man, that he always distinctly indicates which are the fruits of his own individual labours, and which the contributions of other men of science.

This conduct of Humboldt is in perfect harmony with his great modesty and conscientiousness. He respected the scientific achievements of others ; he used them as open loans, in order to benefit, by this mutual exchange, the cause of objective science.

The perusal of the works of Alexander von Humboldt will speedily convince us that his extraordinary memory possessed such an abundance of scientific knowledge, that he continually compares, quotes, corrects, confirms, or refutes.

In the explanation of a single fact, the result of his own experience, he had before his mind, clear and distinct, the aggregate amount of scientific acquisitions. Hence his works, especially those purely scientific, contain, besides the continuous text of his own hand, a most valuable appendix, relating to all branches of physical science, and to almost every period of human history, — an immense array of notes, quotations, comparisons, &c.

These numerous notes are a proof of the unexampled universality, immense information, and extraordinary survey of Alexander von Humboldt. In the composition of his works he observed much prudence. They were originally written in the French language, the medium of the civilized world. By these means, their speedy circulation was much accelerated.

Their general influence insured the progress of the newly-awakened interest in physical science, besides securing a comparative examination of his method of investigation, and its general acceptance.

His works have been translated into several languages. Some were translated under Humboldt's own supervision, and from others extracts and treatises have been incorporated into the languages of different nations.

THE COSMOS.

It has been already intimated that Humboldt intended to publish the sixty-one lectures delivered in the winter of 1827-8, both in the university and the music-hall of Berlin, relating to Physical Cosmography, but that a variety of circumstances compelled him to postpone this project to some future day. He considered the delivery of this series of lectures before a public of varied degrees of intellectual development, a means of ascertaining the relative connection of the various branches of science, and for that purpose he had previously delivered similar lectures in Paris. He communicated his conception of science on these occasions extempore and without notes. Not before the year 1843-4, he wrote down, for the first time, the substance of these lectures, and, in doing so, he had to regard the signal progress of science in the intermediate period, and the rapid development, maturity, and certainty in its varied branches. But in order to give to his subsequent descrip-

tions uniformity and inherent vitality, he proceeds from the position of physical science at the period mentioned—the year 1827-8, and notices the progressive development of natural philosophy.

This may be considered the external history of the stupendous work which has appeared in modern days under the name of “Cosmos.”

But this work has also an internal history, and reveals the life of Alexander von Humboldt in its intellectual development. It is the testament and the legacy which he left to the world.

Humboldt himself remarked, “that on the evening of his eventful life he would offer to the German nation a work, the picture of which had been, though in indefinite outlines, for more than half a century before his mind.”

He recognised the importance of his scientific legacy, for he knew that his individual life must soon come to a close. The realization of this great object had often appeared to him impossible. Yet he resolved to complete the results of his life-long researches, and believed that he owed the world a general *résumé* of his more than fifty years’ observation and study. Hence he returned again and again to this great project, feeling an increasing anxiety to make the mag-

nificent results of his labors beneficial to his own country, and to the world at large.

The work in question he wrote originally in the German language.

The principal aim of Humboldt's extensive investigation was to regard all natural phenomena in their general and absolute relation—nature as a whole—pervaded and sustained by internal powers. The discovery of a supposed isolated phenomenon aided the mutual process of investigation. Humboldt explains the complicated causes of the multifarious forms of being, and ever directs to the all-pervading laws relative to the connection of all natural phenomena.

The favourable position of Baron Humboldt aided considerably the execution of his work. His own personal exploration, not only of the coast of transatlantic countries, but his penetration into the interior, and the investigation of extensive regions in two hemispheres, revealed to him most remarkable contrasts of natural life,—the South American tropics and the steppes of North Asia.

These phenomena urged Baron Humboldt to comparisons and general surveys; they enabled him to recognise the union of heaven and earth—the great picture of the physical Cosmos.

The abundance of his material proved a valuable present to men of science, illuminated, as it was, by perfect order and classification. The general survey of his investigations, which he presented at the evening of his splendid career to his native country, he dated from the period when he first appeared as a public teacher—his lectures in Berlin.

Humboldt perceived, more than any one else, the great difficulty in producing a work which would furnish a faithful and lasting picture of a world engaged in the perpetual process of formation and development.* He had ever in view the continually increasing insight of mankind into nature's laws, and the extension of natural phenomena.

Works on natural philosophy lose their applicability in process of time, and disappear. Humboldt, however, one of the most faithful

* "I grow, I grow. All is nascent, infant. When we are dizzied with the arithmetic of the savant toiling to compute the length of her line, the return of her curve, we are steadied by the perception that a great deal is doing; that all seems just begun; remote aims are in active accomplishment. We can point nowhere to anything final; but tendency appears on all hands: planet, system, constellation. total nature is growing like a field of maize in July; is becoming something else; is in rapid metamorphosis."—(R. W. Emerson's Oration, "*The Method of Nature*.")

disciples of science, inspired by the dignity of the study of nature, was not discouraged at the prospect of the inevitable and necessary perfection of human knowledge; for he was conscious that in many important branches of science he had been one of the foremost pioneers, and had assisted in laying foundations not easy to remove.

It is certainly more than probable that yet isolated phenomena will be subjected to general laws; that new forces of nature will manifest themselves; that apparent homogeneous matter may be indefinitely multiplied, or regarded in its progress according to the laws of evolution;—independent of all these probabilities, the achievements of Alexander von Humboldt will be of importance for the most remote periods of time. It is Alexander von Humboldt who brings us face to face with nature in her unceasing activity, and directs us to everlasting and unchangeable laws which regulate all stages of physical transition.

The genial manner in which Alexander von Humboldt represents nature, furnishes not only the purest, and the most elevated kind of enjoyment, but aids likewise the progressive development of the highest intellectual capacities; giving us an insight in the more profound

purpose of life. The intercourse with nature, manifesting to us in every form and every motion an intelligent government, is pre-eminently calculated to ennoble man, by aiding him to realize his own consciousness.*

In the Introduction to the "Cosmos," Humboldt, speaking on this subject, asserts that the primary step of man regarding the appreciation and the enjoyment of nature, does not depend on his insight into the activity of the

* "There is something in the contemplation of general laws which powerfully persuades us to merge individual feeling, and to commit ourselves unreservedly to their disposal; while the observations of the calm energetic regularity of nature, the immense scale of her operations, and the certainty with which her ends are attained, tend irresistibly to tranquillize and reassure the mind, and render it less accessible to repining, selfish, and turbulent emotions. And this it does, not by debasing our nature into weak compliances, and abject submission to circumstances, but by filling us, as from an inward spring, with a sense of nobleness and power, which enables us to rise superior to them, by showing us our strength and innate dignity, and by calling upon us for the exercise of those powers and faculties by which we are susceptible of the comprehension of so much greatness, and which form, as it were, the link between ourselves and the best and noblest benefactors of our species, with whom we hold communion in thoughts and participate in discoveries which have raised them above their fellow-mortals, and brought them nearer to their Creator."—*Sir John Herschel.*

various forces of nature, and is also not materially influenced by the peculiar or the general character of a region. He said: "Where in extensive plains uniformly associated plants cover the ground, and where the eye surveys an almost unlimited expanse, where the waves of the sea play gently near the shore, in every department of nature we realize an indistinct presentiment of her existence in accordance with internal and everlasting laws."

If such conception of nature reveals to the observer a mysteriously-hidden influence, he will enjoy its invigorating power in his soul. It will pacify the heart, allay raging passions, restore peace, and he will admire the remarkable directness with which nature unfolds her secret powers. I apprehend that every sentiment of solemnity and of seriousness, which in such moments possess the heart, is based on the almost unconscious perception of a higher order of things, an internal law of nature.

The enjoyment offered by nature is within the reach of all, not only the man of science, but accessible to those less informed, perceptible on all points of our earth, manifested in the continual changes of both the animal and vegetable life.

Humboldt recognised a yet higher enjoy-

ment of nature, not merely in its great features, but in the attraction and the interest which the special character of a region may afford. He remarked that such impressions are more vivid, more positive, and especially suited for certain conditions of the heart. We may perhaps at one time notice the fierce contest of the elements,* or be attracted by the sight of the apparently immobile and sterile, or again witness the immense expanse of prairies and deserts, and in turn regard the more cheerful picture of a cultivated country.

It has been said that an investigation of the constitution of nature and of her internal powers divests her of the charms of the mysterious, and the character of the sublime. If in that case the power of our imagination is circumscribed and the charm of immensity of necessity contracted; if an erring philosopher even supposed "that the ignorance of natural phenomena" was the main-spring of sublimity and beauty, there is no doubt that an intelligent insight into the absolute relation of all phenomena, if acquired and exercised in the spirit of Humboldt, will conduct us to the highest possible step worthy of thinking man. It will

* See Jarve's "*Scenes in the Sandwich Islands; the Ocean and a Volcano in strife.*"

ennoble our heart, awaken our interest in the pleasures of a higher intelligence, and lead us to the conception of the divine.

Each law discovered leads to the conclusion that there is a still higher law yet unknown ; our increased insight into nature expands the conception of the infinite. Humboldt has said, "The opinion that the investigation of nature interferes with our enjoyment of the varied aspects of her phenomena is but the result of contraction, or of sentimental melancholy." "Those forces of nature which lie beyond the territory of the generally acknowledged conditions of physical phenomena exert their influences apparently enveloped in darkness."

The observer who, by the aid of a heliometer or a prismatic calc-spar, determines the diameter of planets, who calculates for years the meridian height of one and the same star, who recognises between dense nebulous spots, telescopic comets,—feels—and it may be considered fortunate regarding the success of his labours—that his imagination is no longer affected. Neither is that of the botanist who examines a flower, or investigates the structure of a leaf-moss, its simple or double, the free or the annular inter-grown teeth of the seed-capsule. The investigation of numerical relations, the

careful observation of detail, is the preparatory step to a higher insight into the universe and its laws.*

The physicists who, like Thomas Young, Arago, and Fresnel, investigate the irregular long streams of light, which, according to distance, either annihilate or else intensify themselves; the astronomer who, by the aid of the telescope, investigates the moons of Uranus on the extreme limits of our planetary system; or men who, like Herschel, South, and Struve, in analyzing glimmering points of light, discover them to be coloured double stars; the botanist who discovers the circulating motion of the tiny sap-balls, perceptible in the chara-plant, in almost every vegetable cell, — to all such investigators, — both the immeasurable space of the heavens, and the aspect of our earth in its varied phenomena, is certainly a more sublime sight than to him who has not yet obtained this higher insight into the absolute and necessary connection of all natural phenomena.

* “ There is a lesson in each flower,
A story in each stream and bower ;
On every herb o’er which we tread,
Are written words, which, rightly read,
Will lead us from earth’s fragrant sod
To hope, and holiness, and God.”

Humboldt offers in his "Cosmos" a general picture of nature, a survey of her phenomena. The word "Cosmos" embraces the universe, its laws, and its beauties. Beginning with the remotest nebulous spots in the heavens, he descends gradually to the multifarious life of our earth. In this "all" Humboldt laboured for half a century with keen perception, and an ever clear and calm mind. His pictures of the universe are the result of his own extensive experience. If we consider this "all" filled with a world-ether, a volatile fluid, we perceive it in the first instance densified in the nebulous spots of the heavens; in an increased density in the comets, yet still penetrable by the rays of light, until in the planets gradually all degrees of density are reached, from that of antimony and metals, to that of honey, water, and fir-wood; inasmuch as one planet represents the more, the other the less dense matter.

In the complete picture of the universe, as it is represented in the "Cosmos," man above all occupies a conspicuous place. Humboldt examined with peculiar interest the different gradations of the various races and their geographical distribution. For this purpose he regarded especially the historical development of mankind, their origin, the fundamental uni-

formity of language, their immutability in an original direction of heart and mind. He, like many other philosophers, became convinced of the oneness of human kind. The various languages he considered the intellectual creation of mankind,* which, in their development, intimately intertwined, manifest a national form, and become hence of considerable importance in the recognition of the similarity and the diversity of the various races of mankind.† But here he recognised likewise the limits of his physical picture of nature, which he will not overstep.

Professor Max Müller, in his lectures on the science of language — second series — introductory lecture, pp. 7-8, said: “The whole natural creation tends towards man; without

* It was a profound saying of Wilhelm von Humboldt, “that man is man only by means of speech, but in order to invent speech he must be already man.”

† “Some believe that there are 4,000 living languages, others that there are 6,000. The mode of defining them is clearly a mere matter of opinion. Strabo tells us that in his time, in the Caucasus alone—a chain of mountains not longer than the Alps, and much narrower—there were at least seventy languages. In South America and Mexico, Alexander von Humboldt reckoned the distinct tongues by hundreds.”—(See “*Geological Evidences of the Antiquity of Man*,” by Sir Charles Lyell, Bart., F.R.S., pp. 458—460, and 461.)

man nature would be incomplete and purposeless. The science of man, therefore, or, as it is sometimes called, anthropology, must form the crown of all natural science." Bunsen, when addressing, in 1847, the newly-formed section of Ethnology at the meeting of the British Association at Oxford, said:—

"If man is the apex of creation, it seems right, on the one side, that an historical inquiry into his origin and development should never be allowed to sever itself from the general body of natural science, and in particular from physiology. But, on the other hand, if he is the end to which all organic formations tend from the very beginning; if man is at once the mystery and the key of natural science; if that is the only view of natural science worthy of our age, then ethnological philology, once established on principles as clear as the physiological are, is the highest branch of that science for the advancement of which this association is instituted. It is not an appendix to physiology or to anything else; but its object is, on the contrary, capable of becoming the end and goal of the labours and transactions of a scientific association." *

* Report of the British Association for the Advancement of Science (1847), p. 257.

In his continued activity in all branches of science, Alexander von Humboldt became conscious of the gradual decline of his physical powers.

In reviewing the latter years of the life of this renowned philosopher, we find that he inhabited for a long time, in a quiet part of Berlin, a house in the "Oranienburger Strasse," formerly the property of the father of one of Germany's hero-poets, the well-known Theodor Körner.

In an aged valet, named Seiffert, who had been the companion of Humboldt in his exploration of the deserts of Asia, and who was for nearly forty years acquainted with all his habits, he found, more especially in the declining years of his life, a most valuable and devoted servant and friend.

The peculiar military appearance of this personage could not escape the notice of the visitors who entered the house of Alexander von Humboldt, and his whole bearing produced the impression of his entire devotedness to his illustrious master.

Those who obtained access to the great savant were first conducted by Seiffert to the waiting-room, a place filled with various kinds of birds, fishes, &c., scientific instruments, its walls being adorned by landscape paint-

ings ; from thence, through the library, to the audience-room, which has become familiar to a great number of the public. Humboldt entered this room from a private cabinet to receive his visitors, and pointed them to a seat on the sofa, whilst he took his place in an arm-chair, near his writing-desk, being ready to hear, encourage discussion, or lead the conversation. To listen to him was undoubtedly the desire of every visitor, and in a kindly manner he encouraged their addresses.

Humboldt was a man of middle stature, his feet and hands were small ; his massive forehead adorned by snow-white hair ; his blue eyes lively, expressive ; his lips, around which played a peculiar smile, half benevolent and half sarcastic, were the involuntary expressions of his superiority of mind.

He walked at a pretty quick pace, though with somewhat faltering steps, his head slightly bent forward.

During his conversation he looked habitually on the ground, but would frequently raise his eyes in expectation of a reply, or inviting further discussion.

An inexpressible sign of sympathy was manifested in his noble countenance, if he recognised in his visitor a man of taste and mind.

In such a case, his conversation was unrestrained, full of wit and humour, though he always expressed his opinion with delicate consideration, and was ever master of the word. Humboldt knew many languages: the Englishman praised his pure English, the Frenchman his Parisian accent.

About thirty years ago, Humboldt rose regularly at four o'clock in the morning during the summer months; received visitors so early as eight o'clock, and only about twelve years ago he stated occasionally, that he was compelled to pursue his scientific labours at a time when most people were asleep, because he was during the ordinary business hours obliged to be with the King; but he could, speaking from experience, content himself with four hours of rest. In his latter days, however, after he had reached the age of eighty, nature demanded her right. He rose subsequently not before eight o'clock, over his frugal breakfast perused the letters received, and answered the more important immediately. He afterwards dressed himself, in order to receive visitors, or to make visits himself. At two o'clock he was again at home, at three drove, nearly every day, to dinner at the royal palace, from whence returning at seven, he occupied himself until nine

with reading or writing ; proceeded again to the Court, or into other society, and returned generally about midnight. In the silence of the night this remarkable man commenced his real scientific labours, and not before three o'clock, when in summer already the new day greeted him, he allowed a short rest to his body, so powerfully influenced by its master spirit. During the closing years of his life he was, however, compelled, in consequence of frequently returning illness, to deviate from this rule.

Humboldt was never married. The children of his brother claimed and received his love. His birthday, September 14th, was generally celebrated at the Castle Tegel, the residence of his niece, Madame de Bülow. On that occasion his friends assembled, and science and art presented their cordial homage to the illustrious man.

Although to all appearance Alexander von Humboldt led the quiet life of a man of science, he was, nevertheless, a magnet, who attracted the foremost minds of all nations, whose intellectual focus he was, and through him all scientific events were directed towards Berlin. His house was, to the end of his days, the centre of numerous intellectual aspirations, and he was intimately associated with all that was good,

noble, and wise. Every honest effort found in him a warm and sympathizing friend, whilst, on the contrary, he opposed every kind of unreality. Having once recognised the true and the good, Humboldt was ready with encouragement, with counsel, and with assistance. From the most remote parts of the globe he received applications for advice, not only in scientific, but in public matters. To afford assistance to real talent, he considered an imperative duty. He knew neither envy nor resentment, and no opposite opinions could wound him, if he was assured that they originated from a desire after true knowledge.

And though the outward life of the great savant seemed, in the latter period, calm and quiet, he was, nevertheless, in active communion with the whole world, manifesting a youthful energy of mind. A pension granted by the King of Prussia, and the well-deserved success of his published works, afforded him pecuniary means in excess of what he required, considering his frugal manner of life. The surplus he employed in furtherance of science, and in acts of beneficence.

Towards the close of his life he suffered from frequent indisposition, especially colds, and as soon as his illness became known, the whole

civilized world evinced the greatest concern. The newspapers furnished bulletins, and the highest personages in Europe inquired by telegraph, or personally, concerning the state of his health.

Alexander von Humboldt was on intimate terms with kings; himself a courtier and a baron, living in the immediate circle of royalty, he was yet a liberal man, a friend of personal freedom, a stanch supporter of every free development of thought, an admirer of the just, the true, and the beautiful. He never countenanced the sinister attempts against public rights, which frequently manifested themselves in his immediate circle, and repeatedly expressed his true conviction concerning them. Humboldt recognised the right of all men to individual liberty, assured that it is inseparable from perfect growth, both in nature and in mankind.

During the latter period of his more quiet life, Humboldt was chiefly engaged with his "Cosmos," which appeared, so far as the first division of the fourth volume, in 1858. Besides the gradual completion of this work, he had to furnish a preface to the works of his friend Arago, who, like many other of his friends, had been removed by death. In the spring of 1858,

Humboldt received the news that the youthful friend and companion of his American travels, Aimé Bonpland, had finished his noble career on May 4th, in that year, at the age of eighty-five, at St. Anne. We are already acquainted with a part of the history of this celebrated botanist, his confinement by the Dictator of Paraguay, and his liberation and return to Buenos Ayres. Bonpland manifested in his energy and intellectual capacities, a striking resemblance to Humboldt ; for he not only made very minute and extensive investigations in his adopted country, but undertook in his advanced age (in 1856) a journey to Patagonia. Persons who met this distinguished man about ten years ago, at Porto Alegre, spoke with enthusiasm concerning the amiable character, the youthful energy, and the intellectual activity of the aged philosopher. And, be it said to the honour of the New World, that they knew how to appreciate his scientific importance ; and it is a cheering proof of the progressive development of the Spanish territories of America, and, in general, of the advancement of the population of Central and South America, that Bonpland, the founder of a transatlantic botany, received the general homage of these peoples ; that the public press, especially of La Plata and Brazil,

noticed all his movements, and recorded the progress of his journeys and his arrival and departure at various places. It may be said that the growing interest in the progress of science manifested itself in an equal degree in those parts; in the homage paid to Bonpland, as in Europe in the universal recognition of the illustrious Alexander von Humboldt.

The journal of Montevideo, *Commercio de la Plata*, called Bonpland "a man unaffected by his age, in the full possession and vigour of his intellectual powers; still engaged in new projects and travels, an unwearied servant of science."

Germany likewise cherished the memory of the ancient companion of Humboldt; and, in order to keep his name continually before the scientific world, the official organ of the Leopold Academy called itself "Bonplandia," and surveyed, in the spirit of the renowned philosopher, the entire field of botany.

During the closing years of his life he was actively engaged in establishing a museum at Corrientes, in which all the natural productions of the country should be exhibited. In this laudable project the Governor, Dr. Pujal, his friend and supporter, evinced the greatest interest. It is more than probable, judging from his letters, that he had another object in view,

if possible, more dear to his heart; viz., to bring his extensive and well-arranged Herbarium to Paris. To unite his collections and MSS. with those of his fellow-labourer Humboldt, was the ardent desire of his heart, and expressed by him on various occasions. He wished to see his native land once more, before his final departure, once more to behold the Jardin des Plantes, and, above all, once more to embrace his beloved and revered friend Humboldt.

In his unceasing activity to further agriculture and industry in the Argentine States, and for which he sacrificed many a night's rest, death overtook him, on the 4th of May, 1858.

From the manner in which Humboldt received the news of his friend's demise, it has been supposed that he had a kind of presentiment that their re-union in another world would not be long delayed.

One more glance upon the long and eventful career of Alexander von Humboldt, ere we follow the great explorer to his final resting-place. In his continued intercourse with those powers, which are for ever engaged in the process of dissolution, he had himself become infirm.

How beautiful is the picture of his original

character in every period of his life, in his youth, his manhood, and his old age ; always faithful, always consistent. When he first commenced his geological studies at Freiberg, and was more intimately associated with one of his fellow-students, Freiersleben, with whom he, for the first time, descended into the mines, we find his character already shaped as it appears in his latter days. On that occasion his fellow-student said : "The most prominent features of his amiable character are unwearied kindness, warm sympathy for friends, and love for nature ; modesty, simplicity, and sincerity in his whole conduct ; always attractive powers of communication ; a cheerful and humorous disposition."

Those qualities which assisted him in after-years to obtain the good-will of the savage races, amongst whom he lived for a long time, and in the civilized world everywhere admiration and sympathy ; the same traits of character gained him, in his early youth, the general friendship and love of his fellow-students.

The expressions of Göthe, after Humboldt had paid him a short visit in December, 1826, indicate the further development of his character. In a state of considerable excitement, Göthe said to Eckermann, who entered his room soon after Humboldt's departure :

“Alexander von Humboldt has honoured me with his presence for a few hours this morning. What a remarkable man he is ! Though I have known him some time, I am anew surprised, and ready to say that in thorough knowledge he has no equal, and a universality which I never encountered before. Choose any topic you like, and you will find he is at home. He will remain a few days, and I feel already as if I had lived with him for years.”

We have hitherto endeavoured to notice principally the labours of Alexander von Humboldt in a scientific sphere ; but, as he had been likewise honoured with the unconditional confidence of his king and his country, he was charged with various diplomatic missions, though much against his own inclinations. In giving a short *résumé* of his political labours, we find that he undertook his first mission in the year 1794, charged with the inspection of certain mining districts in Prussian Poland, from which he was suddenly called away, in consequence of the war at that period, and he proceeded to the Rhine and to Frankfort, in order to assist in the political deliberations of the Prussian Minister, von Hardenberg, the English Ambassador, the Earl of Malmesbury, and the representative of Holland, Admiral

Kinkel. Being a personal friend of the Prussian Minister, and above all suspicion, Humboldt was requested to accompany him to head-quarters, charged with the necessary correspondence, and with missions to Field-Marshal Möllendorf.

Humboldt became thus engaged in political affairs without any desire of his own; a field quite foreign to him, and certainly not congenial to his taste and habits of life. In a letter dated from the English head-quarters, near Heden, in Brabant, September 10th, 1794, he said:—"My life has never been so diversified as it is at this time. I have been called away from my proper vocation, and burdened with engagements connected with the diplomatic mission of the Minister von Hardenberg. I have chiefly followed the head-quarters of Field-Marshal Möllendorf, and am at present in the English camp. I proceed on the 14th inst. to the county of Altenkirchen, in order to inspect certain mining districts; and from thence to the camps near Kreuznach and Frankfort. And although these continual changes afford me little pleasure, I am, on the other hand, too much distracted to become sad and melancholy. I have acquired additional information in consequence of my travels in mineralo-

gical districts, which will be of importance in furtherance of my work on the different strata."

New political differences called Humboldt again, in 1796, to the field of diplomacy. He had hastened from Bayreuth to Berlin, in order to remain for a few months near his mother, who had suffered for a considerable time from a lingering disease, when this unexpected summons arrived. The French army under the command of General Moreau had suddenly invaded the duchy of Würtemberg, and had caused the flight of the Duke. The King of Prussia feared that the principality of Hohenlohe might be subject to the pillage of the advancing army under Moreau and Jourdan, but hoped,—in consequence of the existing amicable relations of Prussia and France,—obtained by the treaty of peace concluded at Basle, April 5th, 1795, by the Prussian minister von Hardenberg,—to dispose the French general favourably concerning this principality.

Humboldt proceeded, in company of a Captain Pirch and a single trumpeter, to the headquarters of the French army. On his road he observed the noted balloon of Condé, which had been kept filled for months, and in which General St. Cyr watched the movements of the enemy at the battle of Cannstadt.

His mission proved successful, and he had the good fortune to meet with General Desaix, who had been for some time acquainted with the designs of Bonaparte concerning Egypt, and who endeavoured to persuade Humboldt, instead of visiting the tropics of America, to accompany the French expedition to Egypt. Humboldt, however, returned, at first, to the mountains of Bayreuth, in order to prepare himself, by practical studies and observations of various kinds, for his projected transatlantic explorations.

In 1814, Alexander von Humboldt accompanied the King of Prussia on his political mission to England, and proceeded in September, 1818, again to that country, in order to execute the commission of the Allied Powers in preparing a survey of the South American colonies. In the month of October following, he was called to the congress of Aix-la-Chapelle, and appeared likewise in company of the King of Prussia at the congress held at Verona in the year 1822.

He was present with the Crown Prince of Prussia in May, 1830, at Warsaw, at the opening of the constitutional diet by the Emperor Nicholas. Soon after this, the news of the downfall of the Bourbons, and the accession

of Louis Philippe to the throne, was announced. Humboldt, who had been for some time on intimate terms with the family of Orleans, was chosen as the representative of the King of Prussia, and proceeded in the month of September to Paris, in order to congratulate the new dynasty. He was at the same time charged to furnish the King of Prussia—with the assent of the Court of France—with reports concerning political affairs. In this capacity he remained from September 1830 to May 1832; and again during the years 1834-35, he resided in Paris, the appointed political agent of Prussia.

On every suitable occasion, his grateful fatherland offered to him the homage due to his remarkable activity, extraordinary achievements, and superior knowledge, though his characteristic modesty resisted the appellation of being the first man of learning in Europe, and he pointed to Arago and Gauss as his superiors.

From every assembly of German physicists he received either a respectful invitation, or in latter years a hearty greeting, which he at all times cordially acknowledged. In August, 1858, the University of Jena invited him to their jubilee, to which he replied in the following significant words:—"My diligence, my

hearty participation in the free, public and intellectual development of Germany, are unimpaired ; but my physical powers are rapidly declining ; and I am for that reason prevented to appear, where the dearest memories and the deepest gratitude require my presence."

But not from learned societies only, received Alexander von Humboldt public testimonies of homage ; many private individuals presented, in various ways, and frequently in a delicate and affectionate manner, their spontaneous tribute of admiration ; either in valuable productions of nature or otherwise.

I would only mention, of the numerous presents which Humboldt received on his 89th birthday, a painting offered by two students of Breslau, representing him as a teacher, surrounded by his celebrated friends and pupils ; amongst them his brother Wilhelm, Leopold von Buch, Lichtenstein, Chamisso, Ritter, Erdmann, and others,—a gift accompanied by a poetic dedication, borrowed from Göthe. At the same time the public journals announced that the Nicaragua Society, established to effect a connection of the Atlantic with the Pacific, had taken steps to elect Humboldt their honorary president.

In the year 1858 the friends of Humboldt

perceived every indication of a rapid decline of his physical powers : they could no longer keep pace with his ever-youthful mind. From various sources we learnt that he was prepared to return his weary body to its mother-earth. He too—like his friend Göthe—who acknowledged, in his old age, that existence had been to him little else than weariness and unrest, “the eternal rolling of the stone,” longed for rest. And how affecting is his request in the journals of the spring 1859, in which he asks the general public to excuse him now, in the late hours of the evening of his life, with their numerous demands of all kinds ; and not to consider any longer his house “a public office for general inquiry.” How significant is his request to allow him, after an annual correspondence with about 2,000 persons, a little time for his own work.

It is evident that if such an active and ever willing servant of science and humanity, after a self-imposed activity of more than half a century, at last complained of his burden, he must have been convinced that his time was but short. A further sign was that the contents of his letters were shorter, less sure, and less intelligible. Another symptom was his great exhaustion, and the peculiar nature of his disease, which

caused frequent colds. In April he wrote the last page of his now completed "Cosmos." The consecrated priest of nature had studied his own frame so well, that he did not deceive himself. At the beginning of May, 1859, his friends were suddenly alarmed by the news, that, in consequence of a cold, he had already for several days kept his bed. The bulletins of the two physicians who attended Humboldt—Romberg and Traube—confirmed his critical position. His physical strength had rapidly diminished, but his mind remained unclouded, though his speech had become more feeble. Till near the hour of his death he was perfectly conscious; his last thoughts were with the King of Prussia, his faithful friend of many years, who, away from his country, suffered from an incurable disease. To the last whispered words of his niece, Madame von Bülow, his nephew General Hedemann, and his faithful servant Seiffert, he gave a distinct reply. Soon afterwards he became silent, and died calmly in the afternoon, on May 6th, 1859, at the age of 89 years, 7 months and a few days.

The whole city of Berlin received the news of his demise with profound grief. The electric spark, the confidential friend of Humboldt, conveyed speedily the sad news to all civilized

nations, from country to country, from one part of the world to the other. He was indeed Alexander the Great in science, the greatest intellectual hero of this century.

The simplicity of his life was in perfect harmony with his inheritance. He neither left any real property, nor yet a will. His library, jewels, and pictures, he had conveyed, by a deed of gift, to his faithful servant Seiffert.

He was buried in a princely style on the 10th May. He had been for many years a most faithful friend of the royal house of Prussia, a high officer of state, and an intellectual hero, who had laboured for more than two generations, without intermission, in the furtherance of the intellectual progress of mankind.*

By order of the Prince Regent, his funeral was a public one. But it is certain, that not the pomp of the funeral procession prompted almost the entire population of Berlin, even the poorest labourer, to line the road, and await, bareheaded, the arrival of the remains of the great dead. No, it was the universal con-

* Of him it may be said, in the words of the poet :—

“ His virtues walked a mighty round,
Nor made a pause, nor left a void :
And sure the eternal Master found
His single talent well employed.”

viction that a man had died to whom the whole race owed a great part of their intellectual progress. At daybreak the people already assembled "unter den Linden" and in the "Friedrichsstrasse." In the house of the departed the mourners assembled, in the midst of the *atelier* of his labour and thought. In the room, well known by Hildebrand's picture, stood the plain coffin with the mortal remains of Alexander von Humboldt. Many persons hastened, in order to look, for the last time, on that peaceful countenance, now cold and rigid. Slender palms, and exotic plants in full bloom, surrounded the coffin, calling to mind the period when Humboldt, in the full vigour of youth, undaunted by the numerous obstacles and dangers, explored their native land, and opened a new world for science.

Soon after eight o'clock the coffin was removed to the hearse. The procession was headed by the servants of the departed, and other servants of the family von Humboldt, followed by nearly six hundred students of the University of Berlin; next appeared eight members of the clergy, and immediately after them the hearse, preceded by three chamberlains carrying the insignia of the Order of the Black Eagle, the Order Pour le Mérite, and

other numerous orders of the illustrious Humboldt. Six royal grooms led the horses of the hearse, besides five court lackeys, and an officer of the court. On each side of the hearse walked twenty deputies, specially chosen by the students, with palm-branches in their hands. The plain oak coffin was adorned with palm-branches, wreaths of laurel, and a garland of white azalea blossom. Behind the coffin walked the immediate relatives of Humboldt, headed by the Knights of the Black Eagle. Next in this cortège appeared the Ministers of State, the Commanders of the Army, the Officers of the Court, Foreign Ambassadors, and other distinguished strangers—the Members of both Houses of Parliament, the Judges of the Supreme Court, the Members of the Academy of Science—whose senior Humboldt had been—the Professors of the University, the Members of the School of Art, the Masters of all the public schools in Berlin, the Magistrates and the Council of the City, headed by the Chief Bürgermeister; and lastly, a long train of persons belonging to all classes of society. The state chariot of the King and Queen of Prussia drawn by eight horses, the carriage of the Prince Regent, and those of the other members of the Royal House of Prussia, closed this imposing

procession. When the hearse reached the "Friedrichsstrasse," it was received by the Rector of the Gymnasium and his pupils, who sung appropriate hymns while the hearse passed by. The procession passed the university, and during the ringing of bells and the chanting of appropriate hymns by the Sängerverein of Berlin, the hearse reached the doors of the cathedral, where the Prince Regent, the Prince Friedrich Wilhelm, and the other Princes of the Royal House, together with Prince August of Würtemberg and Prince Friedrich of Hesse-Cassel, awaited, bareheaded, the remains of the illustrious man.

At the principal entrance, the Court Chaplains, headed by Dr. Strauss, received the coffin, and conducted the mortal remains of Humboldt to the front of the altar, where they were placed upon an estrade, surrounded by palms and other exotic plants, illuminated by numerous wax candles. Nearest the coffin the chief mourners and the Royal Princes took their place, and in a separate box several Princesses. Dr. Hoffmann delivered the funeral oration. A short hymn, sung by the congregation, and another by the choir, brought the solemn service to a close.

In the evening the remains of Humboldt were

conveyed to the Castle Tegel, in order to be placed in the family vault at the side of his brother Wilhelm, who had already rested there for twenty-four years, near the white marble statue of Thorwaldsen, representing Hope.

On the morning of the funeral, when all eyes were fixed on the momentous war of France and Austria in Italy, we found in a conspicuous place in the *Kölnische Zeitung* the following lines :—

O ! einen Blick von kriegsbedrohten Stätten,
Nur einen Blick auf ein geöffnet Grab !
Ein grosser Geist will sich zur Ruhe betten,
Ein deutscher Alexander sinkt hinab,
Der ohne Schlacht Unsterblichkeit errungen,
Und weiter als zum Indus vorgedrungen.

Napoleon III., in the midst of this war, as soon as the news of Humboldt's death reached him, gave immediately orders that a statue of the great savant should be placed in the gallery of the Château de Versailles ; at the side of which the statue of another illustrious man has recently been placed, that of Richard Cobden.

Humboldt, like all the great lights of the last century, was the offspring of the spirit of Protestantism, and like them, a true ornament of genuine Protestantism. During a long life of three generations, he devoted all the remarkable

powers of his master-mind to the one great object, to explore the whole physical Cosmos, in order to make his discoveries serviceable to mankind. In pursuit of this great object, he not only sacrificed the ordinary enjoyments of life, but he jeopardized his health and his life, renounced the possible acquisition of material wealth, and the happiness of family life. The unconditional devotion to his great object, and the cheerful sacrifice of everything in furtherance of it,—this is Humboldt's moral worth; and in this devotion he is so great that but few of the children of men can approach him. This noble self-sacrifice is true morality, and such morality is at the same time piety; for the devotion to a great moral thought is indeed a devotion to a thought of God. The self-denying devotion of Alexander von Humboldt in order to comprehend nature and her laws; to realize its being and its truth, must have shown him, in the creature, the Creator. He was in his devotion to the Universe at the same time a devoted servant of the Spirit of the Universe; and he may doubt this who tears God and the world mechanically asunder. His wonderful activity, his rare achievements, have exercised upon the present generation such a powerful influence, that thousands of his contemporaries

have long enjoyed the beneficial results, without even knowing it ; for he was an intellectual sun illuminating all territories of life ; the salutary influence of which has been experienced by all who can feel and think, though moving in the narrowest limits of existence.

Of all intellectual pursuits, the study of nature affords unquestionably the most satisfactory kind of enjoyment. Certainly it is less exciting, and does in a less degree influence our imagination and passions, than the study of human nature ; it being essentially objective, and more free and positive, than the researches into the subjective regions of morality, feeling, and fancy ; it rewards the patient inquirer with more valuable results than any other study can possibly offer ; it preserves the energy of the mind, and kindles the love of the sublime, akin to that higher disposition of the soul, the conception of the infinite and the free,—the realms of the purely intellectual.* The progress of the

* I converse with the Almighty through the instrument of nature, through the history of the world. Every condition of the human soul has some parable in the physical

physical sciences has been in more than one sense of greater benefit to mankind, the furtherance of culture and civilization, than any other science. Its material benefits are innumerable. "Science contributes to almost all our wants, satisfying those of the most material and the most intellectual of our nature; and she serves also to lessen some of the greatest

creation, by which it is typified; and not only artists and poets, but even the most abstract thinkers, have drawn out of this rich store-house. Lively *activity* we call *fire*; *time* is a *stream* which rolls violently away; *eternity* is a *circle*; a *mystery* is veiled in *midnight*; and *truth* dwells in the *sun*. Yes, I begin to believe that even the future fate of the human spirit lies prophesied in the dark oracle of the corporeal creation. Every succeeding spring, which drives the sprouts of plants out of the lap of the earth, enlightens me on the alarming riddle of death; and refutes my anxious apprehension of an eternal sleep. The *swallow* which we find torpid in winter, and see revive again in the spring-time, the *dead grub*, which in the shape of a *butterfly* rises in the air, young once again, offer us a striking *emblem* of our *immortality*. How admirable are all things to me now. There is for me no longer a solitude in all nature. Where I discover a *body*, there I anticipate a *soul*—where I observe *motion* I conjecture *thought*; "where no *dead man* lies buried, there shall be no *resurrection*;" still *omnipotence* speaks to me through its works, and thus I understand the doctrine of an *omnipresent God*."—(Philosophic letters by *Friedrich von Schiller*, written in the year 1785, in the 26th year of his age. See *Oxford Quarterly Magazine*, March and June, 1825, pp. 175-176 and 177.)

evils connected with our social state. War is an evil unhappily incident to mankind at every stage of advancement ; and history proves that the more this calamity depends for its support and its success upon mere physical force and individual prowess, the more likely is it to be barbarous and prolonged. 'All that raised the hero, sunk the man,' said Pope. Every one must be aware that modern warfare has, by the aid of science, become more certain, more decisive, and more brief, and has thereby done much for human happiness. Professor Hennessy said in his essay 'On the Relations of Science to Modern Civilization,' 'The resources which science now places at the disposal of civilized nations engaged in war, not only allow them to strike more energetic blows, and thus the more rapidly terminate the conflict, but also enable hostile powers to more accurately estimate each other's strength, and thus to more equitably weigh all the considerations that may induce them to maintain war or to return to a state of peace.' And if the formidable armaments which science has already furnished, and is yet able to perfect and to multiply, 'should'—to use Professor Hennessy's words—'fortunately not be required, they will have far more effectually performed their work

by assisting to avert war, than if they were actually employed with the most overwhelming results.' The proudest triumph of science is perhaps its moral influence in elevating the mind to form judgments strictly derived from facts, no matter whether such facts tell for or against our preconceived notions. The method employed in communicating the truths of science, as well as the methods by which its advancement is achieved, are eminently adapted to impress the necessity of truthfulness, sincerity, and candour upon all its cultivators."

We do, however, not advocate the cause of physical science to the exclusion of all other sciences, for we believe that all intellectual progress must needs exist side by side, if mankind are to maintain the position in civilization already achieved. Poesy, religion, and philosophy, almost unconsciously aroused by nature, prepared in their progressive development, the human heart for a more perfect enjoyment of nature. With the investigation of nature mankind advanced towards their ultimate destiny. Only since the time of Newton, mankind learnt to investigate more systematically the phenomena of nature. The study of natural laws—the comprehension of which constitutes the highest degree of our elevation above the mere

animal creation—is the acquisition of the last few centuries, not yet concluded, and capable of a development whose limits we dare not venture to guess. “The perpetual evolution of active forces will, — as Humboldt observed, “bring us by a more profound research to the gate of new labyrinths ;” but it is even this multiplicity of untrodden and intertwined roads which produces at each progressive step a happy surprise. Each law revealed to the observer leads to the conclusion that there is a still higher law yet unknown ; for nature is, as Carus, in his work, “The Original Parts of Bone and Shell Skeletons,” said, “for ever growing, continually engaged in the process of formation and development.” A progressive insight into the law of evolution will deepen in us the conviction of the infinitude of life in nature ; we shall perceive that upon the solid earth, in the atmosphere by which it is surrounded ; in the depth of the ocean, and the heavens high above, the courageous explorer will, after the lapse of thousands of years, still find immensity. The recognition of the absolute necessary, the comprehension of cause and effect, and the yet unsolved problem, “the knowledge of the natural and necessary connection of all things and all phenomena,” is, according to Professor B. Cotta,

“the most important object for the solution of the naturalists.” Studies which embrace the minute investigation of separate branches of science afford valuable material in unfolding general laws, pervading the united life and activity of our planet; and perhaps may in their progress aid to solve the apparent contradiction, which is at first sight manifested, in the combined effects produced by the ever-contending forces of nature. They furnish us with general ideas concerning the things created, be it the matter which may form remote planets, or the nearer tellurian phenomena; they will elevate our conceptions regarding the inexhaustible resources of nature, and the immense scale of her operations; they will purify and pacify our soul. The discovery of laws which not only regulate the most delicate and intricate tissue of matter, but govern also the archipelago of dense nebulous spots, and the terrible vacuity of the desert, seem endeavouring to adjust the discord of the elements. A general perception which enables us to recognise each separate organism in its relation to the whole, and to see in the plant or the animal less the individual or the species; but rather a form of nature intertwined with the general process of evolution, will expand our intellectual capacities,

and bring us into a more intimate relation with the universe. An earnest study of physical science will enable mankind to attain their high position, for which they are destined on earth. We became first acquainted with the physical, next the chemical, and now the organic laws;* and it is confidently hoped, that continued observation will yet solve the problem, regarding the cause of all physical activity, which has been sought for in vain by

* "In respect to that evolution which individual organism displays, the question has been answered by the *Germans*. The investigations of *Wolff*, *Göthe*, and *von Bear* have established the truth, that the series of changes gone through during the development of a seed into a tree, or an ovum into an animal, constitute an advance from *homogeneity* of structure to *heterogeneity* of structure. In its primary stage every germ consists of a substance, uniform throughout both in texture and chemical composition. The first step is the appearance of a difference between two parts of this substance; or, as the phenomenon is called in psychological language, *a differentiation*. Each of these differentiated divisions presently begins itself to exhibit some contrast of parts; and by and by these secondary differentiations become as definite as the original one. This process is continually repeated—is simultaneously going on in all parts of the growing embryo; and by endless such differentiations, there is finally produced that complex combination of tissues and organs, constituting the adult animal or plant. This is the history of all organism whatever."—See *Herbert Spencer's* essay, "*The Law of Evolution*."

mere abstract meditation. Apart from the pure enjoyment which the study of nature always affords, the material benefits which result from it are of considerable importance. The apprehension that a more devoted study of natural laws will prejudice other sciences, appears to be unfounded. The great savant whom we endeavoured to describe in these pages, allays our fears; and I have pleasure in quoting his opinion. He says: "If, under protection of wise laws and liberal institutions, all branches of culture advance in a healthy manner; in such a peaceful rivalry, the various efforts of the intellect will not injure the relative interests. Each will offer to the State valuable fruits; the one will secure man's subsistence and wealth; the other—the fruit of a creative mind, more enduring than all material prosperity—records the achievements of human intellect for the benefit of generations yet to come. The study of natural laws awakens in us capacities of which we were scarcely conscious; our acquaintance with nature, though becoming more intimate, does not diminish our interest in all other concerns of life. We shall become convinced of the equal importance of all the branches of physical science, in the furtherance of culture, and the material prosperity of nations. The

investigation of a phenomenon apparently isolated, conceals not unfrequently the germ of a great discovery. When Galvani irritated the sensitive fibres of the nerves by the touch of heterogeneous metals, his next contemporaries did not expect that the contact-electricity of the Voltaic pillar would reveal in the alkalies silver-bright metals, swimming upon the surface of water, and of an inflammatory nature ; that the pillar itself would become the most important instrument in analytic chemistry—a thermoscope and a magnet. When Huyghens commenced to solve the phenomena of light of the calc-spar, no one could foresee that the brilliant achievements of a philosopher of our own days—Arago's, 1811—colored polarization—phenomena would enable us, with the assistance of a small fragment of a mineral, to discover if the light of the sun proceeds out of a solid mass, or out of a gaslike envelope ; if comets reflect their own or borrowed light. A thorough appreciation of all branches of science is of great importance in our own time ; inasmuch as the material wealth and the growing prosperity of nations is based upon the careful use of their natural productions.* The most superficial glance at the present

* "*Civilization*," says *Baron Liebig*, "*is the economy of power, and English power is coal*."—See also *Sir William*

condition of Europe will convince us that an unequal position in the universal competition, or a continued vacillation, will necessarily diminish, and ultimately annihilate the wealth of a nation ; for in the destinies of nations, as in the operations of nature, there is—according to the ingenious observation of Göthe—“ Aphoristisches über die Natur ”—“ in the acts of formation and of motion no delay ; and a curse attached to all cessation.” Only an earnest revival of the study of chemistry, mathematics, and natural history, will arrest the threatening danger. It will be impossible for man to influence nature, to appropriate to his use any of her powers, if ignorant of the laws. Here the

Armstrong's remarks in his address to the *British Association*, at Newcastle, in 1863, concerning the duration of the Coalfields of England.—The statistics collected by *Mr. Hunt*, of the *Mining Record Office*, show that at the end of 1861 the quantity of coal raised in the United Kingdom had reached the enormous total of 86 millions of tons, and that the average annual increase in the eight preceding years amounted to $2\frac{3}{4}$ millions of tons. Assuming 4,000 feet as the greatest depth at which mining operations can be carried on, the entire quantity of available coal existing in these islands has been calculated to be about 80,000 millions of tons, which, at the present rate of consumption, would be exhausted in 930 years ; but, with a continued yearly increase of $2\frac{3}{4}$ millions of tons, would only last 212 years.” See the excellent article on this subject, *Daily Telegraph*, London ; Thursday, January 11, 1866.

power is concentrated in the general intelligence of a people. To know, to perceive, and to enjoy is one of the great prerogatives of mankind; and not unfrequently a recompense for those goods which nature perhaps afforded in a scanty measure. Nations who remain behind in the almost universal competition of industrial activity, in the application of technical chemistry, &c., in a careful selection and cultivation of their natural productions,—nations who disregard this, will inevitably decline; and all the more rapidly, if their neighbours, amongst whom science, and industrial art, exercise a mutual influence, advance with daily renewed energy. But in all departments of physical science, and likewise in the higher regions of the ideal and the emotional,—in the pursuit of history, of philosophy, and of rhetoric,—the first and principal impulse must proceed from within, and be directed to the discovery of natural laws, in their various operation; to the perception of the necessary connection of all changes in the universe. If such a knowledge pervades the industrial life of a nation, and thereby raises the standard of mechanical skill, and of industry in general, such a happy condition has its origin in the fortunate intertwinings of human affairs, according to which the True, the Beau-

tiful, and the Sublime, exercise, with the Useful, as if intentionally, a perpetual alternate influence. A knowledge of natural laws must be the first endeavour of all who wish to become acquainted with the physical cosmos. In proportion to this knowledge, will be the enjoyment which nature affords. In the aspect of the visible nature, with its innumerable diversities of form and colour, we trace the Beautiful, and in the ceaseless operations of the resistless forces in nature we discover the Sublime. “An indissoluble bond unites,—and the grain of sand, as an eloquent writer truly said, which lies the most deeply buried, holds—chained to it by these all-pervading forces—the uncounted worlds which, like luminous sand, are sprinkled by the hand of the Great Creator throughout the glorious universe !” Such a conception of nature will awaken in us feelings of admiration and adoration, and we shall obtain glimpses of the Greatness of that Spirit whose infinite wisdom ordered all things, and whose unfathomable love embraces not only innumerable worlds, but also the most insignificant worm in the dust with equal love and compassion !

“ To Him, whose temple is all space,
Whose altar, earth, sea, skies !
One chorus, let all being raise !
All Nature’s incense rise ! ”

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